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Free Alkalinity in Glass Containers

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(Written for THE GLASS INDUSTRY)

It has long been known that silica-lime-soda glass is more or less soluble and that the degree of solubility may vary considerably due to factors in the process of manufacture. The proportion of the ingredients used in the batch, the length of time the metal is held at a high temperature, and the rate of cooling are the most important factors, and more particularly upon the alkali which will behave as an ingredient in a mixture rather than as an element in a chemical combination.

The amount of alkali in glass which is soluble under normal conditions is so small as to be negligible for most products. It is only when chemicals or preparations very near the neutral point and where the merest trace of alkali will cause a change in color, are being packed, that attention is drawn to the glass. Excessive solubility in alkali also interferes with the keeping qualities of certain biological products as serums and vaccines. The percentage of such products packed in glass compared with the total is so small that when change or spoilage occurs, it attracts attention because of its rarity.

During the past year, this laboratory was called upon to investigate a few cases of bottles supposed to be excessively alkaline. It was soon discovered that there was neither a standard for alkalinity of glassware, nor a standard method of testing. This led to some work to determine what may be fairly reliable test, the time required, et cetera. The review of the rather meagre literature upon the subject furnishes little information and that is not consistent.

In the case of bottles and jars, one is concerned only with the alkali liberated from the inner surface, as that is the only part which comes in contact with the enclosed product. The alkalinity of a given area, as 50 square centimeters, or of a given weight of glass crushed to pass through a screen of a certain mesh, may have a value in some analytical methods, but they are long and tedious and the information derived may have little value in its application to bottles. The area of the interior surface of a bottle will vary with the style or shape and the size. A bottle holding a half ounce or an ounce will have a much greater area of glass exposed proportional to the contents than one holding a quart or a half gallon, and the same will be true for a thin panel compared with a round packer of the same capacity. It is the amount of surface exposed to the action of the contents and not the quantity of glass which determines its fitness or unfitness. Experience has shown that large bottles have been found wholly satisfactory for certain products and that small bottles from the same batch be the source of complaint. This might arise from causes other than mere difference in surface exposure but not in these cases. It was therefore decided to make the determination of alkalinity upon the bottles as they are used and affected by their contents.

Various solvents have been used for the free alkali, but distilled water and dilute sulphuric acid have been preferred and these were used in these experiments. This would seem to be such a simple academic matter that any sophomore could give the answer. A little experience soon dispels the idea, and it is here that we have need for more systematic work on a sufficient number of bottles and over a considerable period of time to determine what constitutes a practical test as well as one which may be more nearly accurate but which may require too much time or manipulation to be used in routine analysis.

There are factors which may give rise to wrong deductions in a hasty alkalinity test. In the case of rapid cooling of glass, alkali may separate on the surface and in the case of bottles stored about the factory for a rather long period some alkali may separate on the surface. Soda ash is extremely light and may be carried by air currents, changes in temperature and moisture cause it to become attached to large bottles and wide mouth jars. Both of these conditions may give rise to a temporary high alkalinity, but which are easily removed by rinsing with water or dilute acid.

The recent practice of pasteurizing at relatively high temperatures and processing above the boiling point has introduced new factors, and glass which may give a low alkalinity

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test or be suitable as a container at ordinary temperatures may be found deficient under the newer conditions. We have no data to show what relationship may exist between the solubility of glass at ordinary and fairly high temperatures such as used in preserving processes.

In order to obtain some information upon the general run of bottles as made in this country a request was made to the various manufacturers for samples of different lines. The response brought in various types of prescription ware, proprietaries, beverage bottles, narrow and wide mouth, and food containers. In capacity they ranged from 5 cc. to 2,500 cc., the majority being between 200 and 500 cc. These were

Free Alkalinity in New Glass Bottles

Number of experiment	Style	Capacity cc.	Solution used	Time expired	Soluble alkali = mgs NaOH per liter Maximum	Minimum	Average
1	Grape juice	240	Distilled water	1 hour	23.3	3.3	14.2
2	" "	240	Diluted acid	1 hour	29.70	4.95	17.62
3	" "	240	Distilled water	1 hour	11.65	5.83	8.84
4	" "	240	Diluted acid	1 hour	18.22	4.99	12.66
5	French square	450	Distilled water	1 hour	6.19	4.33	5.04
6	" "	450	Diluted acid	1 hour	8.14	4.95	6.03
7	Citrate of soda	375	Distilled water	1 hour	2.66	2.23	2.44
8	" " "	375	Diluted acid	1 hour	2.13	1.70	1.91
9	Light green soda	200	Distilled water	1 hour	11.6	10.8	11.2
10	" " "	200	Diluted acid	1 hour	10.6	9.4	10.0
11	Dark green soda	250	Distilled water	1 hour	9.44	8.64	9.04
12	" " "	250	Diluted acid	1 hour	8.96	7.04	8.0
13	Amber malt extract	325	Distilled water	1 hour	9.94	9.33	9.60
14	" " "	325	Diluted acid	1 hour	10.31	9.82	10.06
15	Flint soda	210	Distilled water	1 hour	11.19	10.23	10.71
16	" "	210	Diluted acid	1 hour	12.38	11.42	11.90
17	Light green soda	225	Distilled water	1 hour	11.37	7.46	9.41
18	" " "	225	Diluted acid	1 hour	10.66	9.59	10.12
19	Flint soda	185	Distilled water	1 hour	0.65	0.43	0.58
20	" "	185	Diluted acid	1 hour	1.08	0.86	0.93
21	Tall jelly glass	450	Distilled water	1 hour	7.44	6.99	7.21
22	" " "	450	Diluted acid	1 hour	10.10	9.99	10.04
23	Flint fruit jar	575	Distilled water	1 hour	1.84	1.74	1.79
24	" " "	575	Diluted acid	1 hour	3.82	1.13	2.48
25	Green fruit jar	500	Distilled water	1 hour	1.68	1.28	1.48
26	" " "	500	Diluted acid	1 hour	3.04	2.08	2.56
27	Light fruit jar	500	Distilled water	1 hour	3.68	3.28	3.48
28	" " "	500	Diluted acid	1 hour	3.84	3.68	3.76
29	Green soda	220	Distilled water	48 hours	4.18	...	4.18
30	" "	222	Diluted acid	48 hours	3.09	1.09	2.09
31	Amber packer	2500	Distilled water	48 hours	1.12	...	1.12
32	" "	2500	Diluted acid	48 hours	0.80	0.67	0.73
33	" "	175	Distilled water	48 hours	1.60	...	1.60
34	" "	175	Diluted acid	48 hours	4.57	1.83	3.20
35	Green panel	250	Distilled water	48 hours	1.60	...	1.60
36	" "	250	Diluted acid	48 hours	0.96	0.80	0.88
37	Flint	5	Distilled water	48 hours	26.64	...	26.64
38	"	5	Diluted acid	48 hours	41.29	26.66	33.92
39	Amber saltmouth	130	Distilled water	48 hours	0.92	0.92	0.92
40	" "	130	Diluted acid	48 hours	1.23	0.62	0.92
41	Flint saltmouth	130	Distilled water	48 hours	1.23	0.92	1.02
42	" "	130	Diluted acid	48 hours	1.54	0.92	1.13
43	Fruit jar	900	Distilled water	48 hours	0.44	0.40	0.42
44	" "	900	Diluted acid	48 hours	0.80	0.62	0.71
45	Flint olive bottle	125	Distilled water	48 hours	0.96	0.46	0.85
46	" " "	125	Diluted acid	48 hours	0.96	0.64	0.75
47	Small preserve jar	150	Distilled water	48 hours	1.31	0.78	1.04
48	" " "	150	Diluted acid	48 hours	1.57	0.52	1.04
49	Blue bromoseltzer	17½	Distilled water	48 hours	3.42	...	3.42
50	" "	70	Diluted acid	48 hours	1.19	...	1.19
51	" "	135	Distilled water	48 hours	0.59	0.30	0.50
52	" "	135	Diluted acid	48 hours	1.19	0.30	0.89
53	Flint square	15	Distilled water	48 hours	11.54	...	11.54
54	" "	15	Diluted acid	48 hours	11.54	...	11.54
55	" "	120	Distilled water	48 hours	1.33	...	1.33
56	" "	120	Diluted acid	48 hours	1.99	...	1.99
57	Amber square	120	Distilled water	48 hours	1.33	...	1.33
58	" "	120	Diluted acid	48 hours	1.66	...	1.66
59	Flint panel	190	Distilled water	48 hours	1.89	...	1.89
60	" "	190	Diluted acid	48 hours	2.21	...	2.21
61	Flint	160	Distilled water	48 hours	2.00	1.25	1.66
62	"	160	Diluted acid	48 hours	2.50	1.75	2.16
63	"	250	Distilled water	48 hours	0.48	0.32	0.40
64	"	250	Diluted acid	48 hours	1.39	1.01	1.15
65	Pressed oval	180	Distilled water	18 hours	2.2	1.98	2.16
66	Flint flat ext.	120	Distilled water	18 hours	2.66	1.99	2.38
67	Flint B. N. panel	180	Distilled water	18 hours	2.42	1.76	2.13
68	Flint toilet	135	Distilled water	18 hours	2.37	1.77	1.97
69	Flint salad	210	Distilled water	18 hours	0.57	0.38	0.50
70	Green packer	175	Distilled water	18 hours	0.88	0.22	0.51
71	Green soda	210	Distilled water	18 hours	5.71	1.90	3.33
72	Flint toilet	250	Distilled water	18 hours	10.24	1.60	4.40

given tests varying from one hour to seven weeks with distilled water and dilute sulphuric acid as solvents.

The accompanying table gives the results of a small part of the tests made upon these bottles but enough to give a fair idea of the soluble alkalinity under the conditions given.

Other experiments upon similar lots of bottles to determine the effect of rinsing, of standing for longer periods of time, of removing one solution and replacing with fresh give comparable results, though with the longer exposure the quantity of alkali brought into solution is increased. The effect of standing two weeks is to just about double the original reading and after that the increase proved to be very slow.

The results of these tests indicate that American bottles have a low free alkalinity. This is somewhat at variance with what has been assumed to be true for machine-made ware. The quantity is so low as to be practically negligible for any except the very delicately balanced chemical products. Rather than attempt to meet extreme requirements on all glass ware, and especially for such a small proportion of the trade, it would be better that one or two factories specialize and supply the small demand. The work in the foregoing was done by Mr. H. E. Bishop while analyst at this laboratory.

The Relative Advantages and Disadvantages of Limestone, Burnt Lime, and Slaked Lime*

As Constituents of Common Glass Batches Containing Soda Ash and Salt Cake

By F. W. HODKIN, B.Sc., and W. E. S. Turner, D.Sc.

PART I.

(*Read at the Sheffield Meeting of the Society of Glass Technology, January 19th,* 1921.)

The introduction of calcium or calcium oxide into glass may be brought about in one of three ways, (1) by the use of calcium carbonate in one of its various forms, such as limestone, limespar, chalk; (2) of calcium oxide used in the form of burnt lime; (3) of calcium hydroxide, otherwise slaked lime.

Each of these forms in use possesses certain advantages and disadvantages. Thus, limestone, limespar, and chalk are recommended as particularly useful, since the gas, carbon dioxide, which is evolved when heated in the furnace, exercises a mechanical stirring action and should, apparently, make for homogeneity of the glass and more rapid melting.

Burnt lime will obviously be dearer than limestone; for whilst the decomposition of the latter is carried out inside the glass furnace, the former is the result of a prior and independent heating. There is the advantage, however, that any carbonaceous matter associated with the limestone is burnt out in the lime-kiln, with the result that a better colored glass is often obtained in tank furnaces by using burnt lime. Two serious disadvantages, on the other hand, are (1) its tendency to absorb both moisture and carbon dioxide on storage so that its composition becomes indefinite, and (2) the dust, on handling it, is by no means pleasant, and may, indeed, be quite harmful.

Slaked lime is usually less unpleasant to deal with than burnt lime, and its attractiveness for moisture is also less. It absorbs carbon dioxide, however, and its composition requires to be controlled from time to time.

The constancy of chemical composition and relative cheapness, apart from any advantage claimed owing to the mechanical stirring action of the gas evolved, have set opinion in recent years in favor of limestone and limespar rather than burnt lime or slaked lime. Even in America, where the use of burnt lime is still common practice, limestone has been advocated, and one may reasonably ask whether or not the custom of employing burnt lime in combination with soda ash offers any real advantages.

In any investigation of the problem, it is also necessary to take into consideration the form in which the alkali is added. Both soda ash and salt cake are still in general use, and whilst the choice of one or the other has been guided generally by considerations of relative purity and relative price, it appears from experimental observation that the one cannot altogether replace the other without some influence on the resulting glass. There are, indeed, certain specific influences due to these substances quite apart from serving as sources of sodium oxide.

Gelstharp (*Trans. Amer. Cer. Soc.*, 1914, 16, 109), indeed, has expressed the opinion that for the production of a glass containing more than a limited amount of lime, soda ash alone as the source of alkali could not be used satisfactorily, but that salt cake was necessary. Whilst the limits which he sets may be open to discussion, it is certainly true, as one of us has found in works practice, that slight difficulties have arisen in the production of high lime-containing glasses when salt cake was substituted wholly by soda ash with the view of speeding up production. Whilst the initial melting operation has rapidly taken place, a slight white scum has been noticed on the surface which it has taken a considerable time to get rid of. The introduction of a proportion of the alkaline oxide as salt cake has been very effective in preventing the formation of such a scum.

Apart from this specific influence, it has also been known from practical working experience that glass made from salt cake does possess a difference in fluidity or viscosity from that prepared from soda ash.

For these reasons it is desirable in testing the comparative rates of melting glass containing the different forms of lime that not only soda ash but salt cake shall be brought into consideration.

EXPERIMENTAL

With the object of comparing the relative advantages of limestone, burnt lime, and slaked lime, a series of batches was tested, the composition of which was decided on in view of the foregoing considerations. Thus the following batches were compared:—

A. Soft glass batches containing respectively soda ash and

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burnt lime, soda ash and limespar, salt cake and limespar, salt cake and burnt lime, mixtures of soda ash and salt cake, with limespar and burnt lime respectively.

B. Batches in every way similar to A, but containing proportionately less silica and therefore of a still softer character.

C. Batches similar to B, but containing in addition a small amount of magnesia corresponding to the use of part of the limespar or limestone as dolomite.

D. Batches similar to C, but in which the magnesia was present, not as a total addition, but to substitute one-tenth of the molecular proportion of the soda ash.

E. A set of batches similar to A in which the three forms, namely, limestone, burnt lime, and slaked lime, were compared in soda ash, salt cake, and mixed soda ash—salt cake batches.

Meltings of the above batches were carried out at precisely similar temperatures and under similar conditions in small crucibles. The main object was to ascertain the relative rates of melting and the comparative fluidities of the glasses obtained, and for the sake of clearness on these points, records of other observations are omitted at this stage.

In carrying out the experiments the batch was added to the crucible at the required melting temperature in one filling. At the end of each half-hour after filling on, the progress of the melting operation was tested by dipping a thin fireclay rod into the glass and withdrawing a small sample for observation. The temperature was determined by an optical pyrometer, the reading being made on the top of the pot, the difference between the top and the bottom having been found previously to be approximately 20° to 30°, the bottom being at the higher temperature. At the end of the operation the glass was poured from the crucible in order to give some indication of its fluidity.

The type of batch selected in these experiments was that in common use for operation by rapid semi-automatic or fully automatic machines. It is hoped in another communication to state the results with a glass containing a distinctly higher proportion of calcium oxide.

Statement of Results

TABLE A.

	Batch compositions per 1000 parts of sand.					
Glass No.	417	418	419	420	421	422
Soda ash (95%).	336	336	419	419	—	—
Salt cake.....	111	111	—	—	561	561
Limespar	166	—	166	—	166	—
Burnt lime	—	93	—	93	—	93
Coke	4.5	4.5	—	—	25	25
Comparison at 1350°.						
Melting rate	2	3	4	1	5	6
Fluidity	3	4	5	1	2	6
Comparison at 1400°.						
Melting rate	3	3	2	1	3	4
Fluidity	2	2	2	1	0	4

In regard to fluidity, at 1350° there was little difference between glasses 417, 418, and 419, and less still at 1400°.

The results show that the batch containing the alkali as soda ash in conjunction with burnt lime melts more readily than any of the other combinations. Next in order comes the mixed soda ash—salt cake batch with limespar at the lower temperature, although, at the higher, the soda ash-limespar was first. The salt cake—burnt lime batch was in each case slowest.

TABLE B.

	Batch compositions per 900 parts of sand.					
Glass Nos.	423	424	425	426	427	428
Soda ash (95%).	336	336	419	419	—	—
Salt cake	111	111	—	—	561	561
Limespar	166	—	166	—	166	—
Burnt lime	—	93	—	93	—	93
Coke	4.5	4.5	—	—	25	25
Comparison at 1350°.						
Melting rate	2	2	2	1	4	5
Fluidity	2	2	3	1	4	5
Comparison at 1400°.						
Melting rate	2	3	2	1	4	5

The differences in melting rate were less marked when a melting temperature of 1400° was used than at 1350°. This was the usual experience.

Here again the soda ash—burnt lime was melted most readily and once more the wholly salt cake batches were last.

TABLE C.

	Batch compositions per 900 parts of sand.					
Glass Nos.	429	430	431	432	433	434
Soda ash (95%).	336	336	419	419	—	—
Salt cake	111	111	—	—	561	561
Limespar	166	—	166	—	166	—
Burnt lime	—	93	—	93	—	93
Magnesia (90%).	7.5	7.5	7.5	7.5	7.5	7
Coke	4.5	4.5	—	—	25	25
Comparison at 1350°.						
Melting rate	1	1	2	1	3	4
Fluidity	2	2	2	1	3	4

The results at 1400° were similar to those at 1350°. The fluidity, instead of being reduced by the addition of the magnesia, was distinctly improved and this was specially noticeable at the higher temperature of 1400°. The effect of the magnesia was also to make the mixed soda ash—salt cake batches melt practically as rapidly as the soda ash-burnt lime batch.

TABLE D.

	Batch compositions per 900 parts of sand.					
Glass Nos.	435	436	437	438	439	440
Soda ash (95%).	325	325	408	408	—	—
Salt cake	111	111	—	—	547	547
Limespar	166	—	166	—	166	—
Burnt lime	—	93	—	93	—	93
Magnesia (90%)..	7.5	7.5	7.5	7.5.	7.5.	7.5
Coke	4.5	4.5	—	—	25	25
Comparison at 1350°.						
Melting rate	2	3	4	1	4	4
Fluidity	3	4	2	1	5	

At 1400°, 436 melted and fined slightly more quickly than 435, whilst 439 was also slightly better in these respects than 440.

Some experiments were also carried out at 1450°. The main feature of the results was the greatly increased speed at which glasses 439 and 440 melted and became plain.

TABLE E.

Comparison of Limestone, Burnt Lime, and Slaked Lime

1. Batches containing soda ash.

	Composition per 1000 parts of sand.		
Glass Nos.	469	470	471
Soda ash	419	419	419
Salt cake	—	—	—
Limespar	166	—	—
Burnt lime	—	93	—
Slaked lime	—	—	122
Comparison at 1350°.			
Melting rate	3	1	2
Fluidity	2	1	3

The same results were obtained when melting was carried out 1400°.

2. Batches containing salt cake.

	Batch compositions per 1000 parts of sand.		
Glass Nos.	474	475	476
Limespar	166	—	—
Burnt lime	—	93	—
Slaked lime	—	—	122
Salt cake	566	566	566
Coke	25	25	25

With these batches, meltings were carried out at four different temperatures, with the following results:—

	Comparative melting rates.		
	474	475	476
At 1300°	2	1	3
" 1350°	1	3	2
" 1400°	1	3	2
" 1450°	1	2	2

It will be noted that, except at the lowest temperature, 1300°, the salt cake—limespar combination was melted most rapidly. On the whole, also, the salt cake—burnt lime mixture was slowest.

In regard to fluidity, the glass from batch 474 came first, that from 475 differed from it but little, but with slaked lime the fluidity was least. These results hold for all temperatures, although it is to be noted that at 1450° little difference between the glasses could be detected.

3. Batches containing both soda ash and salt cake.

	Batch compositions per 1000 parts of sand.		
Glass Nos.	484	485	486
Limespar	166	—	—
Burnt lime	—	93	—
Slaked lime	—	—	122
Salt cake	111	111	111
Soda ash	336	336	336
Coke	25	25	25

	Comparative melting rates.		
	484	485	486
At 1300°	2	1	3
" 1350°	1	2	3
" 1400°	1	2	3
" 1450°	1	3	3

As with the previous mixtures, (2), a change in the order of melting rate occurs on change of temperature from 1300° to 1350°, and it seems that the use of burnt lime is somewhat favorable for use in a tank furnace which is not, or cannot be, maintained at a fairly high temperature.

The fluidities of 484 and 485 were similar at 1300° and 1450°. At 1350° and 1400°, 484 appeared slightly the more fluid. In all cases, 486, made with slaked lime, was the most viscous.

General Results

Certain fairly definite results issue from the foregoing tests. In the first place, it is clear throughout all the tests that a batch composed of soda ash and burnt lime melts in all cases faster than any other combination, whilst at corresponding temperatures it is also the most fluid. With soda ash also as the sole source of alkali, slaked lime appears preferable to limespar from the point of view of melting rate.

Only in a slightly less degree is it clear that the salt cake-burnt lime batch is the slowest in being converted to glass, whilst the latter is always more viscous than any other except that melted from salt cake and slaked lime.

Salt cake—limespar mixtures melt quicker than the salt cake—burnt lime.

Between the three batch mixtures soda ash—limespar, soda ash—salt cake—limespar, and soda ash—salt cake—lime there is less marked difference. According to the conditions set out, in some cases one, in some cases another, might be melted most readily. On the whole the soda ash—salt cake—limespar batch may be given first place.

It will thus be obvious that the relative advantages which any one of the three forms of lime may possess may be profoundly changed according as the source of the alkali is soda ash or salt cake.

One further point may be noted, namely, that the glasses made from soda ash alone usually were marked either on the surface or at the edges with a very slight scum. Those prepared from batches containing salt cake or soda ash and salt cake mixed were free from these markings.

Finally, the distinctly different viscosities observed with the different glasses indicate that they cannot possess precisely the same chemical composition, notwithstanding the correspondence between the batches used. Either an equilibrium mixture is not obtained before the glass is apparently ready; or, more probably, the equilibrium mixture is different in different cases, being influenced by small quantities of the original salts, or, in the case of slaked lime, possibly also by traces of moisture.

Density of Glass

The density of glass depends on the specific gravity of its components but cannot be calculated from the density figures in the free state. During the process of glass making a condensation takes place, and the specific gravities are higher in the vitreous condition. The following changes in density take place:

Component	Formula	Density in Free State	Density in Combined State, Observer: Winkelmann	Density in Combined State, Observer: Tillotson
Boric oxide	B_2O_3	1.46	1.9	2.24
Silicia	S_iO_2	2.17	2.3	2.3
Phosphor pentoxide	P_2O_5	2.38	2.55	—
Sodium oxide	Na_2O	2.55	2.6	2.8
Potassium oxide	K_2O	2.66	2.8	2.8
Calcium oxide	CaO	3.15	3.3	4.1
Magnesium oxide	MgO	3.40	3.8	4.0
Alumina	Al_2O_3	3.85	4.1	2.75
Arsenic pentoxide	As_2O_5	4.09	4.1	4.1
Barium oxide	BaO	5.00	7.0	7.0
Zinc oxide	ZnO	5.65	5.9	5.9
Lead oxide	PbO	9.32	9.6	9.6

A New Mineral

The Department of Mines, Ottawa, Canada, has reported the discovery of what is believed to be a new mineral, at Douglas Lake, British Columbia. Investigation and analysis of the mineral by the Department laboratories shows that it is a borate of magnesium, isomorphous with chrysotile, and contains magnesia, 47.87 per cent; boric acid, 41.44 per cent; water, 10.69 per cent. It has been provisionally named camsellite. It is finely fibrous in form and is always found associated with chrysotile and dolomite.

Steam Gauge Glasses

Further Discussion of the Situation Described by the Same Author in the August Issue

By J. F. SPRINGER

(*Written for* THE GLASS INDUSTRY)

It is not difficult to see that it is not an easy job to produce commercially glass tubing suitable for gauge glasses. As to the *character* of the glass, that can, or should, be readily produced to meet the specifications. Only a very few men are concerned in such matters as chemical composition, temperature of the molten glass, annealing and so on. Such matters depend upon knowledge to a large extent and on skill to some extent and any works competent to turn out glass used in the practice of chemistry and other special glasses should have but little difficulty in meeting the railroad specifications in so far as the material itself is concerned.

As to the question of dimensions, that is another matter. It is not very clear just why there should be such an abnormal amount of rejections. Dimensions constitute the principal item, it seems, complained of by the makers, though it is possible they have not closely determined the various percentages corresponding to the several causes of rejection. On the face of things, the difficulties as to size seem more or less the same prior to and subsequently to the war. Thus, the specifications of the Northern Pacific Railway Company, dated June 22, 1914—that is, before the war—require that gauge glasses shall vary not more than 1/32 inch above or below the dimensions wanted. Variation beyond these limits is listed as sufficient cause for rejection. Under date of August 15, 1919, the Pennsylvania Lines, East and West, under Governmental control, issued specifications which required that the inside diameter should not vary more than 1/32 inch and that the diameter variation as to roundness should not be more than 0.01 inch. It is not very easy to see that these Governmental requirements are more difficult to meet than those of the Northern Pacific Railway Company before the war.

The truth is perhaps this. The Northern Pacific Railway's requirements are not representative. Wherever such exactness was not only specified but insisted upon, foreign glasses were supplied to cover part or all of the demand. During the war, and since, the foreign manufacturers have been dropping off in their willingness or ability to meet close specifications. This would throw the demand increasingly upon American manufacturers and they would accordingly have to train more men; and, in some cases, they would be novices themselves in this particular line of activity. Whether this is a correct analysis or not, American manufacturers and apparently foreign ones, too, to some extent, are unwilling or unable to meet the present specifications at present prices.

There are several remedies, and it may be as well to point out some of them.

CHANGE THE SPECIFICATIONS

1.—*Change the specifications.* It is possible that this might be done without sacrifice of necessary qualities. Just what could be done and to what extent is scarcely a matter to be decided in any final way in an article such as this. A committee from the mechanical departments of the railroads might, however, go into the matter and draw up specifications which would take account not only of the requirements for steam operation but also of the conditions of manufacture.

While the writer does not wish to be understood as pretending to settle the matter of specifications, still he would make some tentative suggestions, based in part upon what he has learned from others.

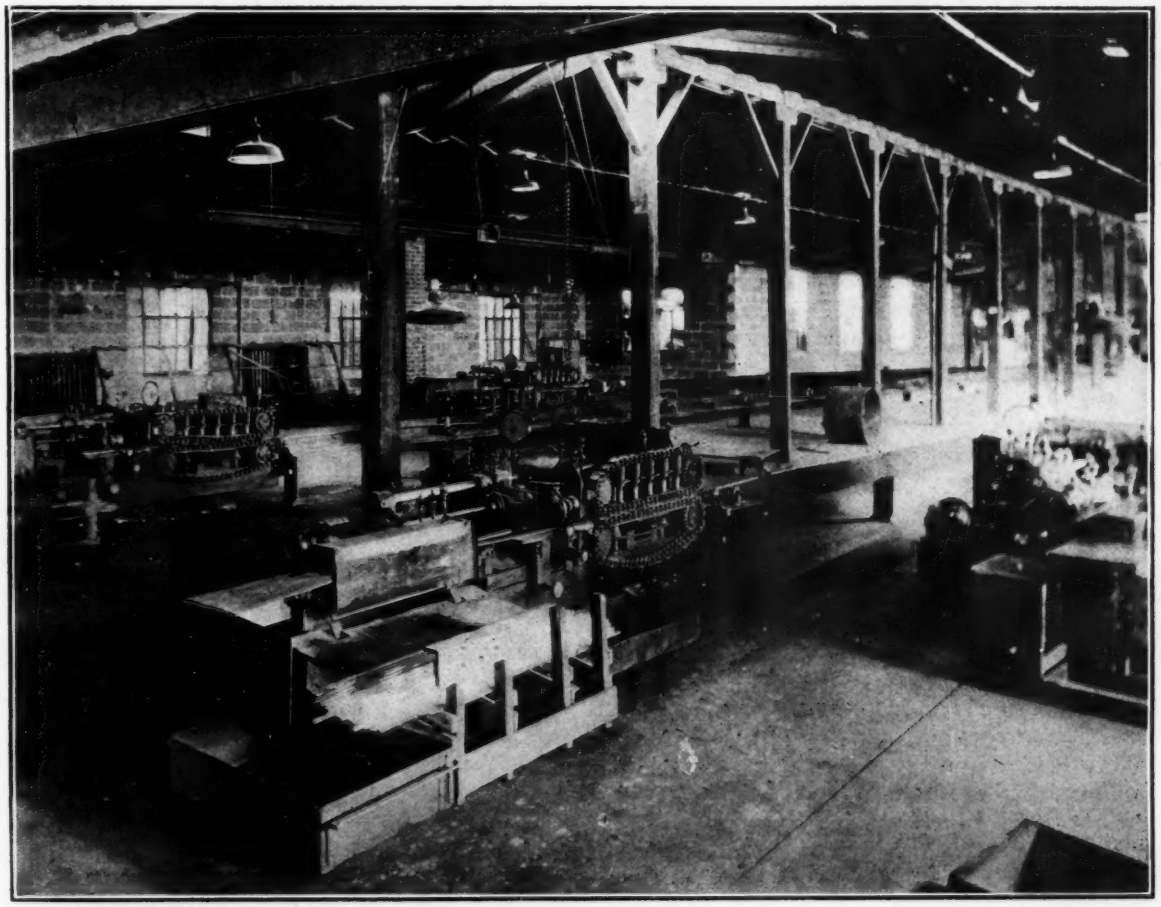
A soft, pliable washer might be required as a necessary accessory of the gauge glass. It seems that at present it is largely the practice for railroad purchasing agents to buy washers without looking sharp to this point.

Price looms, perhaps, too large on the horizon. The material in a washer—a cheap washer—may be of the sort that in service will harden and become more or less vulcanized. Such washers resist spreading. When forced to spread, in order to produce a tight fit, they are liable to crack themselves or to crack the glass.

It would seem quite possible that, with a thoroughly pliant and permanently pliant washer, some increase in the variation of the outside diameter might be allowed. I say nothing final, but simply suggest that the matter might be investigated.

At present, the variation of 1/32 inch plus or minus results in a diametral measurement variation of 1/16 inch—that is, from plus 1/32 down to minus 1/32. The rubber then has, it seems, an annular space to take care of. If the glass tube fits into the metal tube, centrally, then the space between glass and metal will be truly annular. Under this ideal condition, the annular space would, with the present 1/16-inch total allowance on the outside diameter of the glass tube, have a radial thickness varying from 0 to 1/32 inch. But there are two things that may disturb this. First, the axis of the outside diameter of the glass tube may not coincide with the axis of the inner wall of the metal tube. Under this condition, the radial thickness of the space may run from 0 to 1/16 inch. The second thing is the variation in the metal tube itself. The inner diameter may vary somewhat from the nominal dimension. This, however, is a small matter. It should be very easy to have the total variation—that is, plus and minus, both—not greater than 0.01 inch. The possibilities from this side, accordingly, do not change the 1/16 (= 0.0625) inch very much. The annular thickness of the space might, then, run up to a maximum of 0.0725 inch. We may assume, accordingly, that the space between the outside wall of the glass tube and the inside wall of the metal tube may vary from 0.0725 inch down to about 0.0. This represents the present specifications. The question is: May this maximum of 0.0725 inch be safely increased?

It should be pointed out, here, that if some thoroughly effective means be provided to keep the annular ring from degenerating into a circlet whose radial thickness may run down to nothing or near nothing, then the 0.0725 inch would be diminished apart from any change of specifications. There are, in fact, one or two designs of washers which provide for a projecting piece which fits in between glass and metal. But, it is not very clear that this third element would in the end permit us to regard the maximum radial thickness of the space any less than before. However, this type of washer is to be borne in mind. Apart from any reduction of space, there are other qualities of value. The projection serves in any case to interpose resilient material between metal and glass, and this itself may very well be a good thing.



GENERAL VIEW OF AUTOMATIC TUBING DRAWING MACHINES AT FACTORY OF KIMBLE GLASS COMPANY, VINELAND, N. J.

The main thing to consider at this point is whether a soft washer, one sure to spread under pressure, will warrant any increase in the variation permissible in the outside diameter of the gauge glass.

There is another pliant washer which is so shaped as to have a deep and narrow circular groove extending down into the body of the washer from one flat end. That is to say, the washer, if looked at from one end, is seen to be divided, for a distance, into an inner and an outer tube. The groove is the space separating the two. This groove does not parallel the cylindrical surface of the washer, but increases in diameter with the depth. The walls of the groove are, strictly speaking, conical surfaces. When in place, this washer has the flat end, with the opening of the groove next the annular flat surface at the end of the metal tube. The opposite end of the washer abuts against the inner flat surface of the flange of the nut. The mouth of the groove comes next the glass and so has its opening next the annular space between the outer wall of glass and the inner wall of metal. Steam flowing into this annular space enters the groove of the washer. The pressure then tends to separate the two parts of the washer, so that the inner part is forced against the side of the glass and the outer part against the thread of the nut. The whole washer is doubtless pressed up against the horizontal flat surface on the inside of the nut.

Then there is another form of washer which consists of a block of washer material having two opposite flat surfaces connected by a central hole. The hole is, naturally, of cylindrical form. Outside, there is a conical surface connecting the flat ones. In outward appearance, the washer is a frustum of a cone of revolution. This washer naturally spreads when the nut is screwed home. This particular type of washer is recommended by one of the New York concerns supplying gauge glasses to railroads and others as suited to pressures up to 300 pounds per square inch. A somewhat similar

form of washer is one used for marine service. There is the conical outside. At one end the cone approaches the hole so closely that the edge left is rather thin. At the base, opposite, the washer is flanged outwards. This is recommended for high pressures on marine boilers. The material, it is claimed, will not vulcanize.

Then there is the simple washer having two flat surfaces connected by an inner and an outer cylindrical surface. These are simple rings. Made of non-vulcanizing material, they probably suit many situations. There is also a washer of non-vulcanizing material which has a hexagonal periphery. These are supplied for English boilers.

I have now called attention to enough varieties of yielding designs for washers, perhaps, to emphasize the point that such types are already plentiful and that others are doubtless possible. The matter to consider is whether such washers may not be selected from present types or specially designed, with the expectation of using them to take care of an increased variation in the outside diameter of the glass gauge.

One may take this occasion to suggest to purchasing agents that a permanently pliable washer is the thing to buy, however low-priced washers of other materials may be at the time. The cost of the high-quality goods is too insignificant a matter to influence the choice at all. Two washers are required—total cost, say ten cents. A glass breaks—this may mean delay, a scalded engineer, or some other wrong thing. Doubtless a good many purchasing agents know but little of the important service the washers have to perform, and so do not realize that much is being risked to save a few cents per boiler. Of course, the difference in the cost of a great gross is considerable relatively to the price of the low-quality washers; but the actual amount when spread over many boilers becomes insignificant.

REDUCING WASTE

Another method of meeting the specifications commercially concerns itself with the utilization of the waste; that is, the tubing is sorted to get the sufficiently perfect lengths for gauge glasses. The amount of waste might easily be a very great percentage. Under ordinary circumstances where this waste becomes simply scrap glass, the loss of half-manufactured glass is tremendous. Naturally, the net loss becomes a part of the basic cost of the gauge tubes actually chosen for service. The value as scrap relieves the situation very little. However, if the waste tubing could be utilized in sufficient quantity for some valuable service, then the value might be greatly increased. It has been suggested that it could be used for lubricator tubes.

Naturally, this service is not so severe in its requirements. Some railroads, perhaps most, lump the boiler gauge glasses and lubricator tubes together and give one set of specifications for the two. Possibly this might be changed and a separate specification sheet issued for lubricator tubes. It is possible that some items might be made less onerous. If so, this would be a step in the right direction.

At any rate it seems possible that a suggestion made to me at a glass works might fit in here. Substantially, the suggestion is this: Let the standard sizes for lubricator tubes be made intermediate between standard sizes of steam gauge tubes. The one set of sizes would then fit in as between-sizes to the other set. Apparently this would tend to take up all sizes of tubing and have the effect of eliminating rejections at the glass works due to variations in outside diameter too great to satisfy the specifications. The question that would have to be considered in addition concerns the amount of waste that might be thus utilized. Opinions seem to differ on this.

But let us see how this would work out at the glass works. Let us suppose a man at work sorting tubing that has been cut to 6-foot lengths. He holds in one hand, let us say, a hand gauge having two notches for each nominal size. Thus, for the ⅞ inch size the notches will be, respectively, 27 and 29 thirty-seconds wide; that is, one notch is 1/32 inch smaller than the nominal ⅞ inch and the other 1/32 inch larger. If a tube length passes snugly or not at all in "27" but runs easily or snugly in "29," then this length is proper stock for ⅞ inch gauge glasses. Of course part of the 6-foot length may be right and part wrong. Either the whole length is to be thrown out, part thrown out, or divided amongst two or more nominal sizes. To simplify our consideration of the gauging I will assume that each rod is uniform within the limits for a single outside diameter.

AVOIDING REJECTIONS FOR OUTSIDE DIAMETER

For the usual steam gauge sizes of ½, ⅝, ¾, ⅞ and 1 inch, let us substitute 16, 20, 24, 28 and 32 thirty-seconds of an inch. It may be noted that the nominal sizes are separated by intervals of 4. Thus, from 16 to 20 is 4, and from 20 to 24 is 4, and so on. As 1/32 inch is the variation permitted below and above the nominal sizes, we get the following widths for the several pairs of notches:

Nominal sizes	16	20	24	28	32
Gauge notches	15-17	19-21	23-25	27-29	31-33

An inspection of the notch sizes will show that the larger one corresponding to any nominal size is just 2 less than the smaller one corresponding to the next nominal size; and also that the interval from a smaller notch to its companion larger notch is always 2. Consequently we may arrange another set of nominal sizes splitting the intervals that occur between the old and by this means utilize the intervening possibilities. In short, by specifying that lubricator tubes should run nominally 18, 22, 26 and 30 thirty-seconds in outside diameter with a permissible variation of one thirty-second, plus or minus, we will, with the steam gauge list, absorb all the tubing from 15 to 33 thirty-seconds diameter. There would be *no rejections for outside diameter* sizes except for those below 15 and above 33 thirty-seconds.

It is clear from the foregoing, in so far as the mathematics of the sizes is concerned, that this alternation of nominal sizes between the steam gauge tubes and the lubricator tubes would just about solve the problem of rejection for excessive variation of external diameter. The remainder of the solution turns on the possibility of the lubricator tube business being large enough to absorb enough tubing. If we assume that the bulk of the steam gauge business calls for sizes of 20, 24 and 28 thirty-seconds, and that equal amounts of tubing are consumed in the several sizes, then we may roughly estimate that if lubricator tubes for the sizes 22 and 26 thirty-seconds absorbed all the waste occasioned by excessive diametral variation, the amount would have to be around two-

thirds of that absorbed by the steam-gauge business. This is a rough-and-ready estimate and makes no pretense of exactness. It is, however, perhaps not so far from the truth. The question then is, Is the lubricator-tube business extensive enough to take up two-thirds the length of tubing taken up by the steam-gauge business? In considering this matter one must recollect the small average length of a lubricator glass. I am merely passing this suggestion along, without endorsing or condemning it.

TOOLING THE ENDS OF THE TUBE

There is yet another suggestion which developed on my visit to Vineland. This is the possibility of tooling the ends to accurate size. I understand that the glass people would not consider it an onerous matter at all if the specifications, instead of requiring a uniform wall thickness, would permit the ends of the individual steam-gauge tubes to be tooled inside and out to bring the outside diameter close to the nominal size. Apparently they would be rather indifferent as to whether the length of tubing actually involved at the ends, in this tooling, is long or short. A half inch, inch, and inch and a half—all are the same to them, so it seems.

This matter might, accordingly, be seriously considered. Naturally, the external diameter of the main body of the tube might vary considerably from the nominal size without sensibly impairing the usefulness of the glass when in service. The tooling operation is capable of being carried out with some exactness. The permissible variation of 1/32 inch would be easy to meet. Probably it could be reduced if desired. Tooling is done by re-heating the glass, maintaining the size inside by a kind of mandrel, and effecting a relative movement between a tooling instrument and the outside surface of the glass. An advantage would seem to be possible here. The roundness of the tooled portion could probably be maintained within very close limits. The recent specifications of the Pennsylvania Lines, East and West, already referred to, make a point of roundness. They require that the variation in roundness shall not exceed 0.01 inch. Practically, this means that the outside diameter at any one point shall not have a variation in excess of this amount. This requirement could undoubtedly be more than met with the tooling operation.

Naturally, if steam gauge tubes are tooled at the ends and if this operation is carried out at the glass works the effect will be that the tubes will be cut to length at the works as well. Of course those who have hitherto bought tubing in 6-foot lengths and the like and then cut them up to size before selling would have to give up this mode of doing business or else provide for the tooling at their own places. Steam gauge tubes ready for use are furnished in three forms—rough cut at the ends, ground square with the axis, and fused at ends. Where fusing has to be done after cutting up the lengths of stock, arrangements for tooling would probably add but little to the necessary equipment. When grinding the ends is to be done the tooling would be an entirely different operation and would, of course, be done prior to the grinding.

A question arises as to whether the tooling would predispose the gauge glass to fracture. One can do but little more than speculate on this point. Actual tests would seem necessary in order to get a final answer. The tooling would naturally reduce the wall thickness in the regions tooled. There would then be created a circumferential region or zone around the tube at the one end of the tooling, where there would be a change of wall thickness. This change does not need, however, to be an abrupt one. The transition may be made in a gentle manner. But even so, would there exist at this transition location a predisposition to crack? That is the question. If this point admits of being covered, then tooling seems to promise a fair solution of the matter of exact dimensions.

The favorable opinion I got at Vineland on the practicability of carrying out the tooling operation is, I imagine, to be considered as an offhand one and not as an opinion based upon actually carrying out the operation on a commercial basis. Thus, it might be desirable to change any one of the existing characters of a given tube, say the outside diameter. The mechanical question that would then arise would relate to the means for maintaining the internal size during the tooling. This size would vary from tube to tube, and the means of maintenance used would have to take this fact into account. Just how best to proceed in order to meet such a requirement I do not know. Possibly a fixed rod of fixed size would suffice for the inside tool, provided it was of less diameter than the inside of any of the glass tubes. The glass would then naturally be rolled on this rod, or rather rod end, or perhaps a rotary rod of similar diameter relative to the tube would answer requirements. I am not settling anything—I am merely making suggestions for what they may be worth. Another possibility seems to exist. The rod end for the inside might be fixed relatively to the glass but have a slightly conical form. This would permit variations of the inside diameter of the tubing to be met. Doubtless the inventors in the mechanical forming of glass would deal very efficiently with the matter. Of course, if a transition zone is permissible inside and outside, then the problem of tooling is probably quite a simple one. In short, if the railroads and others see their way clear to using gauge tubing with tooled ends the glass people can probably meet them more than halfway.

Unique German Tax Proposal

A bill has been presented before the Reichstag which, if it should be enacted into a law, will make the German Government a shareholder in every German joint stock company, says the International Trade Service of the Guaranty Trust Company of New York. Under the provisions of this bill, the German Government will appropriate, without payment, a certain percentage of the shares of every company. Through this proposed measure the German Government would be brought into closer contact than ever with all forms of business. The attitude of German business men towards this extraordinary proposal of the finance minister has not yet been ascertained, as the bill has not progressed along its legislative course sufficiently to have become the subject of general discussion. The finance minister, however, believes that as the credit standing of any German business concern is far higher than the credit standing of the German Government, the position of the German Government as a shareholder in all German registered companies would be greatly improved.

The Importance of Air in the Glass Industry

By C. A. EDDY*

(*Written for* THE GLASS INDUSTRY)

It is a far cry from the olden days of manufacturing glass to the present day methods and needs. While the changes in this line may have been few in comparison with those in other lines of business, it is a fact that many of the cut and dried methods of years ago are used to advantage by the successful glass manufacturers today.

The man interested in glass making today, unless he be a student of history, possibly gives little thought to old methods or just how glass first came into universal use.

The first mirrors used by the human race were pools of water and these had to serve for a very long time. In the early ages to which history goes back, mirrors were made of polished brass and silver, and glass first came into use for this purpose about three thousand years ago.

Glass was, no doubt, first discovered accidentally from the fusing of soda or potash and sand under a fire, and the first use was in making beads for necklaces and other personal ornaments.

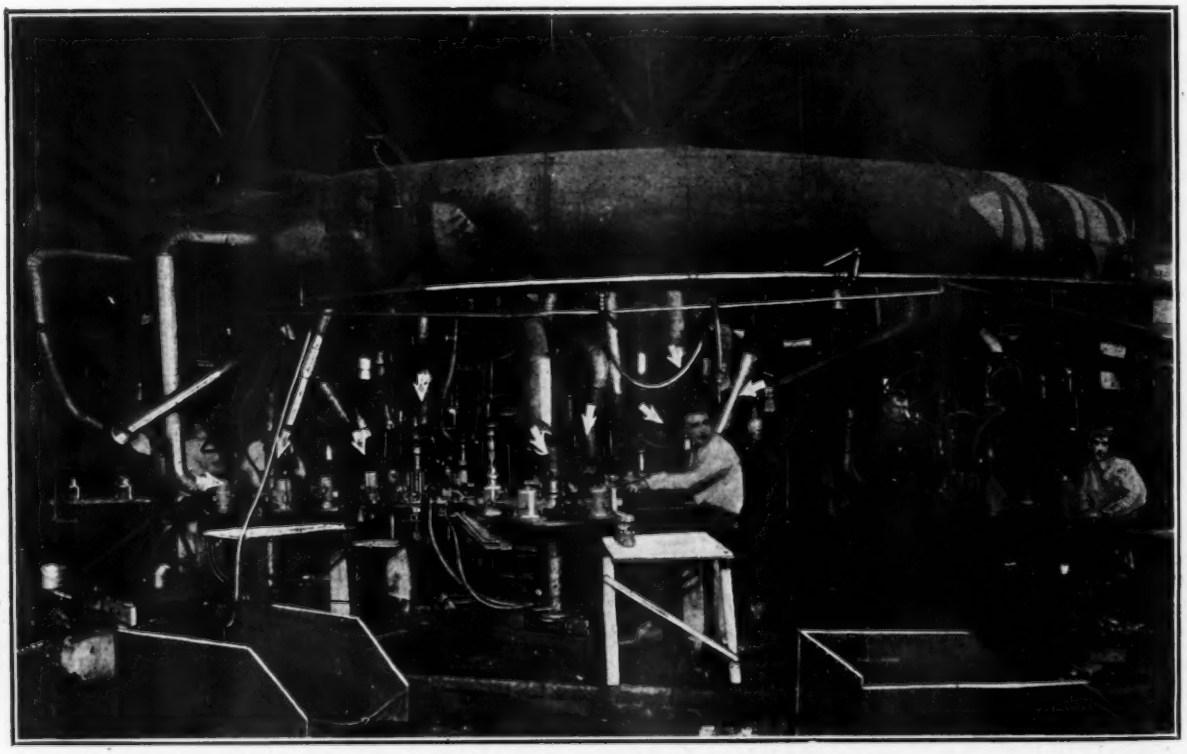
Glass beads in a necklace belonging to Queen Ra-Ma-Ka, wife of Thotmes III, bearing inscriptions in hieroglyphics, who reigned over 3,400 years ago, have been found in Egypt. The art of making glass is also shown on ancient Egyptian monuments, by pictures illustrating glass being blown through long pipes in very nearly the same manner as was in use about fifty years ago.

*American Blower Company.

When the word "window" is mentioned we at once think of glass. The word really means "wind-eye" or wind opening. Windows were first used for providing ventilation and the use of glass for the openings developed many hundred years later.

The primitive windows were covered with skins, which could be partially rolled up whenever the interior atmospheric conditions became such as to attract attention to the need of fresh air.

The inhabitants of Pompeii used glass windows to a limited extent, as excavations have brought to light panes of glass which have remained fastened to their frames, although buried for more than 1,700 years under ashes.



COOLING METHOD EMPLOYED BY ONE LARGE BOTTLE MANUFACTURER. ARROWS POINT TO PIPES FROM WHICH COOLED AIR IS BLOWN ONTO MEN AND MOULDS

It may be interesting to read the description given by the monk, Theophilus, in his "Essay on Diverse Arts," written in the thirteenth century. "At the first hour in the morning, take an iron pipe, and if you wish to make sheets of glass, plunge the end of the pipe into a pot filled with molten glass. Turn the pipe in your hand until as much glass as you wish is collected around it, then taking it out, put it to your mouth and blow a little. Keep a smooth stone before the opening of the furnace, on which you can beat the hot glass a little in order to give it the same thickness all over; you must alternately blow and remove the pipe from your mouth with great rapidity."

He goes on to describe how the glass is blown into the

form of a long hanging bladder by using the flame of a furnace to keep the glass hot during the process, how it is cut and allowed to flatten down within a furnace, into a sheet.

In 1824 a Frenchman named Robinet, who was employed as a glass blower, invented an air pump to do the blowing and this rendered it possible to manufacture glass on a much larger scale and at lower cost. Like all industrial inventions this improved living conditions for the whole human race.

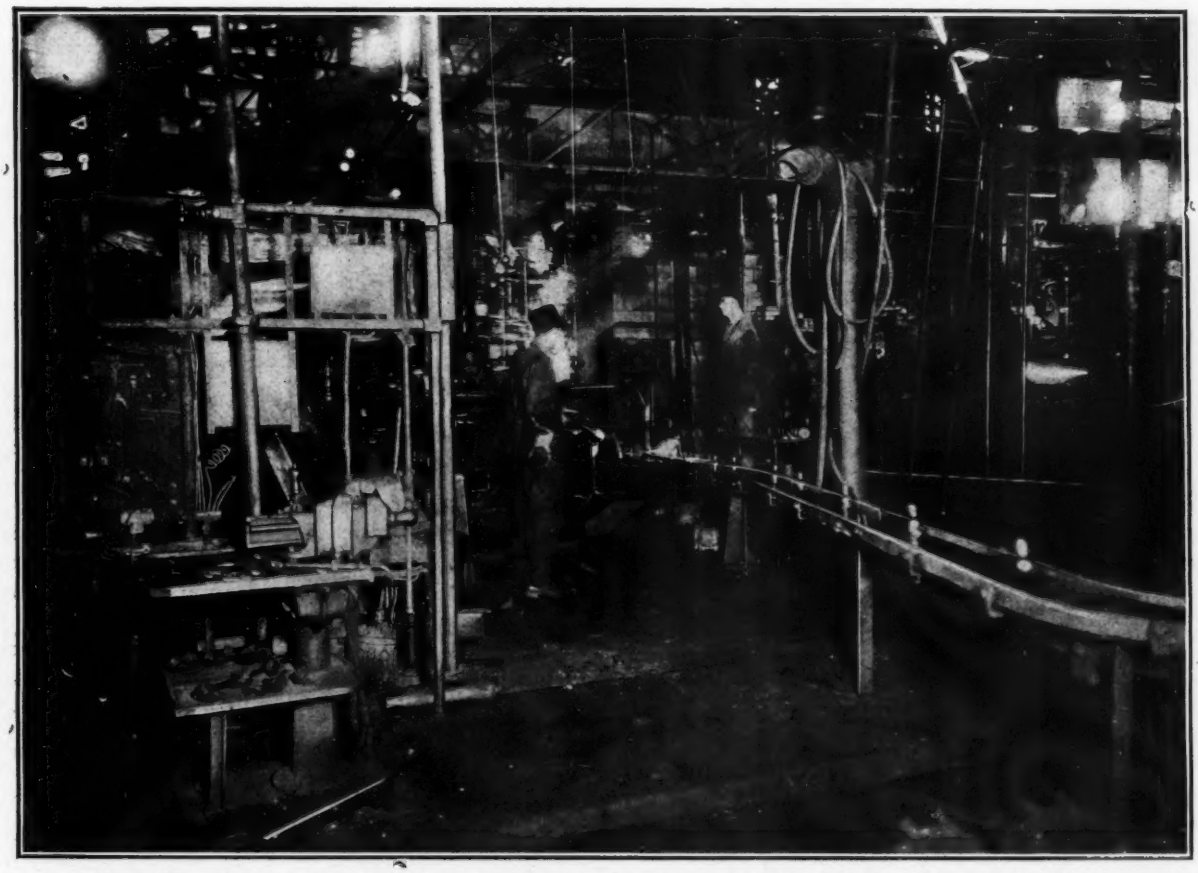
It is unnecessary to follow on down the line to the present day which finds the old art of glass making evolved until it has developed into a tremendous industry.

The men who years ago laboriously blew bottles singly, turning out only a few per hour, little thought of the miraculous machines which are almost human—those machines with the unerring fingers which quickly fashion and form the precise shape of a bottle and what's more turn the finished product out so quickly.

What has brought this change about? It has been a gradual evolution. In the past few years the changes have been more marked than was previously the case. While there are certain fundamentals which are still being followed the same as in the olden days, additions and improvements have become necessary to meet modern conditions.

Today, one of the big things that has to do with this business is the question of man power, because after all, the man power of a factory, no matter whether in the glass industry or some other line, is the big important point. It is true that the automatic machines take care of an enormous amount of work today which formerly was done by men, at the same time the man power in the glass factory still means a great deal when the profit end is considered.

If we are to keep up with competition and get the most from our investment it is necessary that the plant must be run steadily with no long let-ups or extensive vacations, and it is right here where *air* plays an important part in conserving man power. During the sizzling hot days of summer few men can work at a glass machine for any length of time; that is, they cannot unless provision has been made for directing a stream of cool, clear air on them as they work. Men are finding out that it is poor business for them to swelter over the machines without mechanical methods being provided for cooling the air around them, and that is where fans and blowers play their important part in the glass factory.



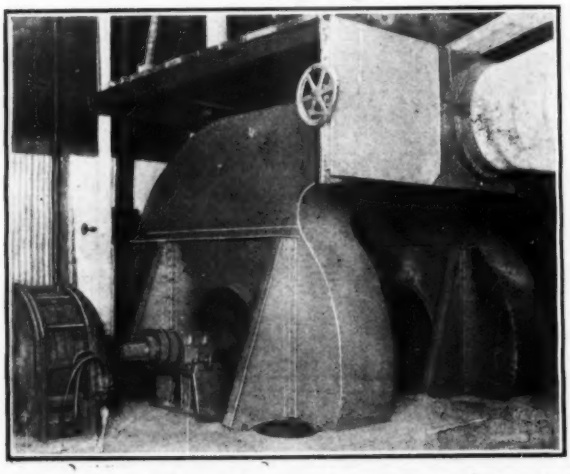
THROUGH THE PIPE SHOWN IN THE FOREGROUND, COOLED AIR IS BLOWN ON THE WORKMEN. THIS COOLED AIR ENABLES THE MEN TO DO MORE AND BETTER WORK IN SPITE OF THE TERRIFIC HEAT AROUND GLASS MACHINES

In checking up the labor situation it has been stated that the plant without cooling methods for the men cannot secure the class of help nor get the work out of the men that is possible with the plant equipped with methods which would at least make them fairly comfortable when at work. One cannot blame an employee for not wanting to work in a plant which takes the best part out of him in the few hours of the working day, when he can be employed in another plant

which provides all possible means for eliminating discomfort.

Aside from the question of man power the use of fans and blowers in a glass plant is a source of great economy in connection with the molds and furnaces. Where blowers are used expensive rebuilding comes up seldom, whereas where cooling methods are not in use this item must be considered often.

For instance, one of the leading glass manufacturers some time ago installed equipment in his plant for cooling furnace walls. The cooling of these walls meant longer life as well as continuous service. In their case the engineer called for a capacity of approximately 50,000 cubic feet of air per minute to be supplied to each furnace, which meant, in round numbers, a total of 300,000 cubic feet of air for the six furnaces which they had installed. Four blowers per furnace were used in throwing a continual flow of air to the walls without



DOUBLE BLOWER INSTALLATION USED IN COOLING GLASS MOULDS IN LARGE GLASS PLANTS

interruption. While this seemed to be an expensive use of power, yet, when the costly replacement of walls along with the interruption of production was considered, this glass manufacturer felt justified in going to the expense necessary. Before they applied air for the cooling of furnace walls the life of a furnace was only from three to six months and after the cooling equipment was installed they were able to use the furnace continually from 23 to 30 months. In tearing down the furnace wall they found it had burnt down to a thickness of only 1½ inches and that the glass on the inside of the furnace had been cooled down and offset the air blast on the outside wall and had thus prevented the collapse of the furnace.

Another prominent glass manufacturer uses blowers to cool glass furnaces while large quantities of molten glass are carried in them and the terrific heat necessarily maintained has a disintegrating effect upon the fire brick walls which under ordinary circumstances last only a few months. This manufacturer is using two good size fans, one to act as a stand-by. The fan in operation provides sufficient air to cool six glass furnaces, each containing from 140 to 175 tons of molten glass.

The depth of the glass in the furnace is about three feet so that it is necessary to cool about the same depth of wall surface. Six-inch diameter discharge pipes are placed around the furnace, blowing air upon the surface of the brick wall in the highly heated zone, the pipe being spaced at about 2 feet 6 inches centers. The fan in operation delivers 90,000 cubic feet of air per minute when run at 285 r.p.m. and consumes 65 brake horsepower. The total pressure at the fan outlet being 2 7/10 inches water gauge. This concern figures that with equipment of this kind the furnace will last about six months longer.

Fans and blowers are used for cooling glass tank walls, eliminating lost time in shutting down for repairs, cooling men working about the furnace lehrs, bottle machines, rolling tables, etc., cooling molds and machines. They are also extensively used in connection with warm portions of buildings to prevent roof condensation. They utilize excess heat from glass tanks for heating other buildings. This is accomplished by installing suitable hoods over the tanks, distributing the hot air from the heated surfaces of the tanks. This accomplishes a double duty by removing heated air from the vicinity of furnaces and utilizing it for heat elsewhere.

The question of economy naturally enters when mechanical ventilating equipment is being considered. The many uses given above show that fans and blowers save money by prolonging the usefulness of furnace walls, eliminating costly repairs, reducing expense for new machines and molds, increasing production and making healthier and more satisfied workmen.

As a matter of fact it is doubtful whether a glass manufacturer once having seen the great advantages of a liberal amount of ventilating equipment in his plant, would try to do business without such equipment. Workmen, once having felt the benefits of cooling air while facing furnaces or red hot glass, would not willingly go back to the discomfort and unhealthfulness of older days.

There are many other advantages but even these should go far to prove that the manufacturer alive to today's needs can, to advantage, make good use of air in the glass industry.

Wooden Posts for Factory Fences

According to a statement in *Technical Notes* issued by the Forest Products Laboratory, there is no choice between round or split posts if the amount of heartwood is the same in both. But if the percentage of sapwood is increased by splitting, the split posts will be less durable, and if the percentage of heartwood is increased, it will be more durable than a round one. Posts of spruce, hemlock or any of the true firs are exceptions to this rule, because their heartwood and sapwood are equally durable.

When posts are to be treated with creosote or other preservative, a round post is preferable to a split post, because of the comparative ease with which the sapwood can be treated. The heart faces on split posts do not, as a rule, absorb preservative well. Split red-oak posts will take treatment, because the wood is very porous, but the heart faces of split posts of many other species, notably white oak, red gum and Douglas fir, resist the penetration of preservative, even under heavy pressure.

Belgium's Glass Production in 1920

The Belgian Ministry of Economic Affairs has issued the following figures showing the production of glass in 1920:

	Sq. Meters	Value, Francs
Plate glass	2,419,315	109,000,000
Window glass	26,449,583	300,000,000

The Glass Industry in Canada in 1918*

Prepared Under the Direction of S. J. COOK†

The products of the Canadian glass industry in 1918 were valued at the factories at $6,578,602. During the same period glass and glassware importations into Canada were valued at $5,430,873, while exports of similar commodities amounted to only $35,267. Deducting the value of exports from the combined values of imports and production, the approximate consumption of glass and glassware in Canada is found to have been $11,974,208. Thus Canadian production met only 54.9% of the Canadian market demand. There seems to be no good reason why the glass industry should not be further developed in this country, the necessary raw materials abound and the market is already developed.

During 1918 nine establishments were engaged in the manufacture of glass and glassware in Canada. Seven of these were located in Ontario, one in Quebec and one in Alberta. The total working capital invested in these establishments at the end of the year amounted to $7,443,525, of which $834,484 represented cash, trading and operating accounts, and bills receivable. Of the remainder, $5,151,009 was the value of the fixed assets including land, plant and equipment while the value of the materials on hand, stocks in process, finished products, fuel and miscellaneous supplies on hand amounted to $1,458,032.

EMPLOYEES

In 1918 the salaried workers in this industry numbered 117, their earnings being at the rate of $1,799 per capita, or $210,512 in all. Of this amount the officers, superintendents and managers received $115,001; the remainder going to clerks, stenographers and other office employees.

The average number of plant workers was 2,215, each receiving an average payment of $908 during the year. The total wages paid to these workers was $2,011,051.

The following table shows the distribution of the salaried employees and wage-earners in the industry on a day when a normal working staff was employed. The works sub-total 2,325 is higher than the average number of wage-earners, 2,215 mentioned above, but this is due to the fact that the distribution was made in December when a full complement of workers was engaged, while the average for the year was lowered on account of the smaller numbers employed during July, August and September. The minimum occurred in August, when only 1,570 wage-earners were at work in the industry.

DISTRIBUTION OF NORMAL WORKING STAFF

	1918	
	Male	Female
SALARIED EMPLOYEES:		
Officers, Superintendents and Managers...	36	
Stenographers, Clerks, Salesmen and other salaried employees	48	33
OFFICE SUB-TOTAL	84	33
WAGE-EARNERS receiving per week:		
Under $10	92	80
$10 but less than $15	229	97
$15 but less than $20	552	16
$20 but less than $25	537	1
$25 and over	720	1
WORKS SUB-TOTAL 2130		195
GRAND TOTAL 2214		228

FUEL

In the manufacture of glass, fuel is an important item among the materials used. Bituminous coal comes first in value among the different fuels used, $352,293 having been paid for 46,651 tons of various grades. Gas comes second, 733,653 M. cu. ft. having been burned at a cost of $146,593, of which sum the larger portion or $145,804 was paid for 729,906 M. cu. ft. of natural gas. Of the last named fuel 579,906 M. cu. ft. was used in Ontario and 150,000 M. cu. ft. in Alberta.

The next table gives the source, quantity and cost of all the fuel used during the year, not including any fuel supplied to their employees by the firms reporting.

FUEL USED IN 1918

		CANADIAN		FOREIGN	
Kind	Unit of Measure	Quantity	Cost at Works	Quantity	Cost at Works
Bituminous coal, slack	Short	.....	.....	267	$1,043
" " lump	Tons	.....	.....	29,084	197,135
" " run of mine	"	.....	.....	17,300	154,115
Anthracite coal, lump....	"	.....	.....	15	37
Blacksmiths coal	"	.....	.....	4,153	32,085
Oil (fuel).....Imp. gals.		7,028	$789	574,203	82,449
Gas .....M. cu. ft.		733,653	146,593	.....	.....
Total $147,382					$466,864

MATERIALS USED

The following table shows the materials used in this industry in 1918, itemized as to quantity and cost at the works.

MATERIALS USED IN THE GLASS INDUSTRY IN 1918

Kind	Unit of Measure	Quantity	Cost at Works	Average price per unit
Glass or silica sand..	(2,000 lbs.)	40,344	$155,854	$3.86
Soda ash (carbonate of soda)	"	13,468	635,068	47.15
Nitrate of soda	"	95	7,905	83.21
Limestone	"	4,490	18,076	4.02
Lime	"	2,190	18,046	8.24
Carbon	"	7	140	20.00
Arsenic, white	lbs.	68,314	8,694	0 12
Manganese dioxide .	"	18,535	1,414	0.07
Litharge and red lead	"	169,987	17,764	0.10
All other chemicals	"	.....	74,556	...
Boxes, cases, etc		.....	367,946	...
All other miscellaneous materials		.....	751,276[1]	...
Total			$2,056,739	

*Advance Chapter of "Chemicals and Allied Products in Canada in 1918."

†Chief of the Mining, Metallurgical and Chemical Division, Dominion Bureau of Statistics, Ottawa, Canada.

[1]This amount includes cost of glass tubing, etc., used by manufacturers of vials and chemical glassware as well as the "all other miscellaneous materials" reported by the other manufacturers.

PRODUCTION

The production from these materials included lamp and lantern chimneys, tumblers, bottles and other pressed and blown glassware made by six firms; vials and chemical glassware from two others; and window glass from one only. The total output was valued at the plants at $6,578,602.

MISCELLANEOUS EXPENSES

Miscellaneous expenditures during 1918 chargeable to manufacturing amounted to $989,747. When this item is added to the salaries and wages paid, the cost of fuel and materials used, the total expenditures for the year are found to have been $5,882,295.

The following table gives the details of the miscellaneous expenses incurred:

MISCELLANEOUS EXPENSES

Rent of offices, works and machinery	$6,984
Rent of Power	55,585
Insurance (Premium for year only)	37,401
Taxes, provincial, municipal, etc	28,023
Royalties, use of patents, etc	108,634
Advertising expenses	3,812
Travelling expenses	73,130
Ordinary repairs to building and machinery	369,388
All other sundry expenses (not including fuel costs, salaries, wages or cost of materials used in manufacturing	306,790
Total	$989,747

IMPORTS

The imports for the calendar year 1918 which are of interest in connection with the glass industry are itemized as to quantity and value in the following table, although it is to be borne in mind that the chemical products listed represent total importations *for all purposes, and not for the manufacture of glass solely.*

IMPORTS INTO CANADA DURING 1918

(From the Monthly Reports of the Trade of Canada)

	Unit of Measure	Quantity	Value
MATERIALS:			
Soda Ash or Barilla	tons	45,569	$1,973.64
Soda, Sulphate of, crude, known as Salt Cake	"	34,387	676,571
Soda, nitrate of, or cubic niter	"	51,996	4,077,903
Lime	"	4,987	53,745
GLASS:			
Glass and Glassware, Balls and cut pressed or molded crystal glass tableware, blown glass tableware and other cut glassware		....	408,959
Carboys or demijohns, decanters, flasks, jars and phials		....	657,113
Common and colorless window glass	sq. ft.	22,123,915	1,809,031
Glass cut to size for the manufacture of dry plates for photographic purposes when imported by the manufacturers of such dry plates for use in the manufacture thereof, in their own factories		.....	56,436
Glass in sheets and bent Glassware, n. o. p.		.....	152,576
Glass plates for discs, rough cut or unwrought, for use in the manufacture of optical instruments		.....	33,285
Lamp chimneys, glass shades or globes		.....	175,559
Ornamental figured and enamelled colored glass and memorial or other ornamental window glass		.....	13,232
Painted and vitrified, chipped, figured, enamelled and obscured white glass		.....	4,038
Plain, colored, opaque, stained or tinted or muffled glass in sheets		.....	27,676
Plate glass, not bevelled, in sheets or panes not exceeding 7 sq. ft. each n. o. p.		1,044,674	432,435
Plate glass, not bevelled in sheets or panes exceeding 7 sq. ft. each and not exceeding 25 sq. ft. each	sq. ft.	309,400	171,357
Plate glass not bevelled, n. o. p.	"	710,369	427,423
Plate glass bevelled, n. o. p.	"	235	170
Silvered glass, beveled or not, framed or not framed	"	.....	133,359
Stained or ornamental glass windows	"	.....	8,744
Other articles of glass, not plate or sheet, designed to be cut or mounted, and manufactures of glass, n. o. p.		.....	919,482
TOTAL VALUE OF IMPORTS			$12,212,733

The exports of glass and glassware of Canadian manufacture during the calendar year 1918 were valued at $35,267.

Diamonds for Glass Cutting

In a lecture delivered by Dr. Morris Travers in the rooms of the Royal Society of Arts, London, and reported in *The Pottery Gazette and Glass Trade Review*, the speaker began with a reference to the question of diamond cutting. Very few people, he said, were aware of the fact that the cutting with the diamond was not done on the point. A perfect diamond should be a solid figure with six cutting edges. It was the edge of the diamond with which the cutting was done, not the point. As the diamond was set in the piece of metal, it was embedded so that an edge was the part with which the cutting could conveniently be done. If the glass was made to bear on the point, the diamond would merely scratch the glass, but when the edge was brought over, the scratching noise of the diamond ceased, and it began to sing, a sign that the cutting was taking place. When one edge of the diamond was worn down, a second could be taken, and even a third, and sometimes a fourth edge. One never got to the sixth edge, because things in nature were not so perfect, mechanically, as they should be.

The Laboratory

By J. B. KRAK

Clarifiers

Clarifiers are added to the batch in order to promote the expulsion of gases from the molten glass and to eliminate substances which cause a dull appearance and lack of lustre, such as carbon and sulphur. In the decomposition of carbonates or sulphates, a large volume of gas is set free, a part of which remains in the glass in the form of numerous small bubbles or seeds. The more fluid the glass becomes, the better the elimination of gas proceeds. Volatile substances which cause the formation of large bubbles carry the smaller seeds away with them in their upward course and are a distinct help in making glass homogeneous. Besides this mechanical action, a chemical change takes place by which oxygen is formed. The oxygen combines with any sulphur, carbon or organic matter present, forming gaseous compounds which are eliminated.

Arsenic

Arsenious acid, white arsenic or arsenic trioxide (As_2O_3), is the most important clarifier. This substance is made by roasting arsenical pyrites (mispickel) FeAsS, and in roasting certain arsenical tin ores before smelting.

The roasting is done in reverberatory furnaces and the vapors of white arsenic sublime off and are condensed as a powder in long horizontal canals or in chambers. The oxide is a white granular powder which is usually ground before packing for market.

TECHNICAL VALUATION OF COMMERCIAL ARSENIC.—Moisture is determined by drying a ten-gram sample to constant weight in an oven at 100° C.

Arsenic as As_2O_3. Dissolve a 5-gram sample with 20 grams potassium carbonate in 60 cc. of hot water. Boil until complete solution is effected. Dilute to 1,000 cc. in a standard flask and take 100 cc. (= 0.5 gram) for analysis. Make the solution faintly acid with hydrochloric acid, add an excess of sodium bicarbonate and titrate with N/10 iodine solution. One cc. N/10 iodine = .004948 gram As_2O_3.

RESIDUE UPON SUBLIMATION.—Weigh a 5-gram sample into a tared crucible and heat gently on a sand bath with the sand carefully banked around the crucible so as to heat the whole receptacle. When the greater part of the arsenious oxide has volatilized the crucible is ignited directly in the flame to a dull red heat until fumes are no longer given off. The residue is weighed as total non-sublimable residue.

Instead of arsenic, white oxide of antimony and also metallic antimony is used to some extent.

A description of the action of arsenic is given under the heading of the Technical Consultation Service in this issue.

Soda Niter

Sodium nitrate, also called chile saltpetre ($NaNO_3$), is found in natural deposits in desert regions along the west coast of South America, especially near the boundary lines between Peru, Chile and Bolivia. The territory is now chiefly owned by Chile. The deposits extend about 220 miles in length and average about 2 miles in width. The formation of these beds is attributed to the decomposition of sea plants under such conditions of temperature and humidity that the ammonia produced was converted into nitrate by the action of the nitrifying bacillus. The region being rainless the sodium nitrate was not washed away.

Saltpeter

Potassium nitrate or niter (KNO_3) is prepared from sodium nitrate and potassium chloride according to the following equation:

$$\underset{\text{Sodium Nitrate}}{NaNO_3} + \underset{\text{Potassium Chloride}}{KCl} = \underset{\text{Potassium Nitrate}}{KNO_3} + \underset{\text{Sodium Chloride}}{NaCl}$$

Commercial potassium chloride, about 80% pure, is dissolved in water and mixed with sodium nitrate containing about 95% $NaNO_3$. The mixture is brought to a boil and stirred well for an hour. The sodium chloride, on cooling, is precipitated and the liquid is drawn from the sediment into crystallizing tanks where it is stirred until cooled down to ordinary temperature. This causes the separation of the niter as crystals.

The importance of both nitrates is based on the evolution of oxygen, which destroys organic matter, forming carbon dioxide and water vapor, and oxidizing the yellow sulphur to sulphur dioxide gas. The evolution of the gases stirs the molten glass. Nitrates facilitate fusion since they melt at low temperatures: Soda niter at 318° and saltpeter at 500° C. At higher temperatures they are decomposed and remain in the glass as oxides of sodium or potassium.

VALUATION OF NITRATES.—Water is estimated by drying a 10-gram sample at 120° C.; chloride by titration with N/10 silver nitrate solution; sulphate by precipitation with barium chloride in hydrochloric acid solution. Iron and aluminum are precipitated with ammonia and separated as described in the analysis of Sand.[1] Other impurities are of little importance. The amount of sodium or potassium nitrate in the sample is estimated by reduction of the nitrate radicle to ammonia with Devarda alloy, and distillation of the ammonia into a known excess of standard sulphuric acid. For details of this method, consult "Standard Methods of Chemical Analysis," by W. W. Scott (D. Van Nostrand Co.).

[1] THE GLASS INDUSTRY, 1921, Vol. 2, No. 1 (January), p. 13.

Japanese Gauge Glass

Gauge glass is being successfully made in a glass factory controlled by the South Manchuria Railway Company, according to a report from the United States Consul at Dairen, and gauges for all of the company's locomotives as well as those of the Chinese Eastern Railway, and the Shantung Railway are now being supplied. The report states that the new factory can compete successfully with American and European manufacturers on account of the cheap Chinese labor available.

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ADVERTISING RATES ON APPLICATION

NEW YORK, OCTOBER, 1921

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New Publication

ECONOMIC MINERALS OF CANADA. Special edition prepared for the National Exposition of Chemical Industries, New York, 1921. By Wyatt Malcolm. Published by the Department of Mines, Geological Survey, Ottawa, Canada. Size 4¾ by 6¾ inches, 34 pages. Gives brief production statistics and descriptions of the deposits of many important minerals found in Canada, including some used in the making of glass as cobalt, feldspar, fluorspar, gypsum, kaolin, lead, zinc, nickel. Coal, natural gas and petroleum are also given attention.

Paper Versus Gold

The science of economics has received some severe jolts in recent years. As a matter of fact, the man in the street is inclined to give more credence to the forecasts of the much maligned Weather Bureau in matters pertaining to its domain than to the utterances of leading economists as applied to the world's work. All signs fail in a drought, and possibly all forecasts of economists should be taken with an unusually large "granum salis" in after-the-war times. Incidentally there lurks a certain doubt in the minds of some people as to the propriety of calling a system which utterly fails in a crisis, a science.

The latest happening which has left the economists flat on their backs, so to speak, is the collapse of the exchange rates of our former enemies, the Central European states. The Polish mark is now worth about three-hundredths of a cent and yet, judging from Poland's activity in Silesia, the country is far from dead. Reports have come thick and fast that Austria is dying, and judging by the value of the crown, Austria had died long ago. But in spite of the dismal prognosis, Austria somehow refuses to die. As for Germany, the low exchange rates do not worry the German people nearly as much as they seem to worry us. Can economists explain why Germany, at this day, has practically no unemployment, while the United States, which not only won the war but also accumulated the larger part of the world's gold supply, has five millions of unemployed workers? Who is the less fortunate, the German worker who receives depreciated paper marks for his labor, which he can exchange for food and shelter, or the American who is out of work?

Economists tell us that unless we give European countries a chance to pay their debts in goods, exchange rates will remain low. It has occurred to many people that if present conditions are allowed to continue our losses will far exceed the total of Europe's financial obligations to us. This much is certain: unless American industry receives protection from the unfair competition based upon the European financial débacle, the possession of the world's stock of gold will not benefit either the American manufacturer or the laborer. Has it been given to Germany to transmute paper into bread and wine, while American gold can only yield a stone?

Technical Consultation Service

THE GLASS INDUSTRY invites its readers to refer to this department any problems with which they may be confronted pertaining to raw materials, glass technology, laboratory and factory practice. While making no pretensions to the possession of unbounded knowledge or infallibility THE GLASS INDUSTRY is ready to assist its readers to the best of its ability in solving their problems. Readers who can offer better suggestions are invited to submit them.

Answers to all questions will be made by mail as promptly as possible. The source of all inquiries will be held in strict confidence.

QUESTION 12.—As a subscriber to THE GLASS INDUSTRY I wish to take advantage of your Technical Consultation Service.

Could you furnish me with information or sources of the same on arsenic as a fining agent in glass, its reactions or chemical behavior, etc.?

Further, would it be possible for you to furnish me with a list of references on glass analysis?

I find THE GLASS INDUSTRY most interesting and helpful

in the solution of many problems pertaining to the industry. I look forward to the arrival of each number with keen interest.

ANSWER.—The use of arsenic as a fining agent is based on the fact that this substance vaporizes rapidly, and on doing so forms large bubbles of gas. These bubbles stir up the molten glass and enable the numerous smaller gas bubbles to escape, thus rendering the glass homogeneous and free from seeds.

Arsenic is used in the form of arsenic trioxide (As_2O_3), which can be reduced to the element arsenic, thereby oxidizing impurities such as carbon and sulphur. On this property depends the use of arsenic as a clarifier, as it increases the brilliancy and limpidity of glass by eliminating impurities.

When an excess of decolorizing material such as selenium or manganese has been used, the glass shows a faint pink color. This may be removed by the use of arsenic, which changes selenium to the colorless oxide and manganese dioxide to manganous oxide, which causes a lighter color than that due to the dioxide of manganese.

Arsenic has a specific gravity of 3.7 while the density of molten glass is about 2.6. To reduce the color of a pot of glass, pieces of arsenic are added carefully, which sink to the bottom. In spite of its volatility, small amounts of arsenic remain in the finished product and can be estimated by the refined methods of analysis developed in recent years.

For a full description of methods of glass analysis we refer you to Uhlig's "Chemical Analysis for Glass Makers."

Recent Publications

GLASS SANDS OF KENTUCKY, by Charles Henry Richardson, Associate Geologist. Published by the Kentucky Geological Survey, Frankfort, Ky. Size 9 x 16, 145 pages.

The Kentucky Geological Survey, in publishing this volume on glass sands has done a service to those who would acquaint themselves with the essential features of glass manufacture. The publication contains a brief description of the properties of glass, the raw materials which enter into its manufacture, chapters on the classification of glasses, types of furnaces and a history of glass in the United States. The larger part of the volume is devoted to sand, discussing fully the selection and preparation of sand and giving a description of the glass sands found in different parts of Kentucky. A chapter on limestone, suitable for glass making is added and the volume closes with a bibliography of 135 publications on glass sand and glass making. The treatise contains numerous analyses of glass sands and is illustrated.

TECHNICAL METHODS OF ANALYSIS, as employed in the laboratories of Arthur D. Little, Inc., Cambridge, Mass. Edited by Roger Castle Griffin. International Chemical Series. Published by the McGraw-Hill Book Company. Size 5½ x 8¼ inches. 666 pages. Price $6.00.

It is a pleasure to announce the appearance of a book on chemical analysis which is not merely a compilation of existing methods, or "the result of several years of teaching quantitative analysis." There is at present an oversupply of both kinds. But there is always a demand for a work which bears the stamp of individuality, and which shows that the writer has mastered his subject, not only at his desk, but first of all at his work bench.

The methods cover the following subjects: general inorganic and organic analyses; analyses of metals, fuels, paints, oils, wood and papers, textiles, foodstuffs and the book closes with a chapter on miscellaneous analyses. The volume contains many methods of calculations and numerous tables which will be appreciated by the busy chemist.

Electric Annealing Furnace Progress

Considerable attention and effort have of late been devoted by practical engineers to the development of electrically heated glass annealing furnaces and the progress made in the application of this type of lehr to commercial uses has reached a point which indicates that the day may not be very distant when glass manufacturers so situated that electric power is procurable at moderate cost, may find it expedient to investigate the possibilities which this new departure in annealing practice may hold for them.

It is significant that one large and reputable electrical equipment concern has so perfected and tested its lehr heating equipment that it is already prepared to introduce its furnaces throughout the trade and is advertising its electric lehrs like any other established branch of its business.

In other industries electricity as a source of heat for annealing and other heat treating and melting purposes is being used extensively. Steel castings and most of the high speed tool steel used in America is produced in electric furnaces. Within the past three or four years electricity has almost displaced the older methods of melting non-ferrous alloys in brass rolling mills and there are numerous electric metal annealing plants in commercial operation. The application of electrically generated heat to glass making so far has been principally to the annealing of high grade products, such as lens blanks and x-ray tubes; and to electric lamp bulbs and the finer grades of table-ware, but there appears to be no insurmountable obstacle to extending electric annealing methods to glass products of all kinds.

Tests made on goblets in a 22 in. wide, 5 ft. high, 10 ft. long, Westinghouse "Hevi-duty" electric furnace[1] at a well-known plant gave a much higher production of first grade ware than is obtained in their natural-gas fired lehrs.

Large telescope lenses are annealed in a 24 KW furnace, 4 ft. 6 in. in diameter, 4 ft. deep, at the Spencer Lens Company's plant, Hamburg, N. Y.

For the Eastman Kodak Company, Rochester, N. Y., a 47 KW, furnace was selected, 18 in. wide, 24 in. high, 5 ft. 6 in. long, having a capacity of 185 pounds of lens blanks per hour.

At the General Electric Company's Schenectady, N. Y., works a 30 KW furnace[2] 5 ft. wide, 15 ft. high, 8 ft. long, with heating chamber 14 in. wide, 4 ft. high, 3 ft. 4 in. long, is in regular use annealing x-ray tubes.

The National Lamp Works at Cleveland, Ohio, use for annealing miniature lamp bulbs a 60 KW furnace, 3 ft. wide, 2 ft. high, 14 ft. long, capacity 10 pounds per hour.

Up to the present, practically no installation and operation cost data on the electric annealing furnace, which could be used in making comparisons with older methods, have been published, but information of this nature will no doubt become available before long.

A method of eliminating bubbles from glass by subjecting it while in a soft state to a pressure of at least 200 atmospheres so that the contained gases are absorbed, is the basis of a British patent applied for by Schott & Gen, Jena, Germany.—*J. Soc. Glass Tech.*

[1] See THE GLASS INDUSTRY, 1921, vol. 2. No. 2 (February), p. 36.
[2] See THE GLASS INDUSTRY, 1921, vol. 2. No. 5 (May), p. 107.

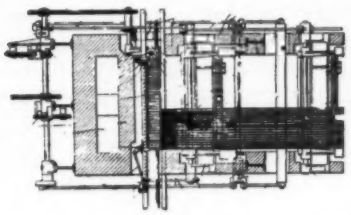
Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Copies of the Patent Specifications mentioned below may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c. each.

Glassware Machine. U. S. 1,386,240. August 2, 1921. Edma H. Curtis, Jr., of Norwood, Ohio.

This invention relates to lehrs and conveyers for use in making glassware, wherein the conveyer carries the ware from the molding machine, deposits it in the lehr automatically and carries it through the lehr if desired.



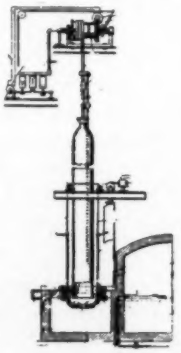
The device within the lehr comprises essentially a series of fixed bars and a series of interlying movable bars which have four movements, to wit: —a forward movement and an upward movement which bring them up between the fixed bars to a level above said bars; a rearward movement, while elevated, and a downward movement which carries them back below the fixed bars.

In combination with the said lehr arrangement, there is also a conveyer, automatically operated, which comprises carrier members having fixed bars to lie in line with the fixed bars of the lehr, and a stop or centering device which lines up the bars of the conveyer with the bars of the lehr, so that the forward movement of the movable bars of the lehr will enter between the bars of the conveyor and lift off the glassware.

The lehr in such an arrangement need not be close up to the molding machinery, since the conveyer from the molding machine does not retain the glassware as it passes through the lehr. If the lehr in use by any manufacturer is equipped with a moving belt for carrying the bottles slowly along in the presence of the annealing heat, then the fixed and movable bars and the conveyer may be readily adapted for unloading the glassware onto the belt, within the lehr.

Apparatus for Drawing Glass Cylinders. U. S. 1,386,441. August 2, 1921. Arthur E. Spinasse, of Mount Vernon, Ohio.

The invention relates to an apparatus for and process of drawing glass cylinders, and is particularly directed toward means and method for effecting the result under conditions which insure uniformity of the product.



The device contemplates a tank, a forehearth or drawing chamber, means for drawing the cylinders from the forehearth for keeping the temperature of the glass in the forehearth properly uniform, for a device adapted to segregate a portion of the glass so kept and to keep the quantity of such segregated mass constant during draw. It also contemplates the use of means for excluding air from the nascent cylinder and for proper and effective cooling of the glass thereof.

Lens-Grinding Machine. U. S. 1,387,232. Aug. 9, 1921. Lucian W. Pugbee, of Indianapolis, Indiana, assignor to One-piece Bifocal Lens Co., of Indianapolis, Ind.

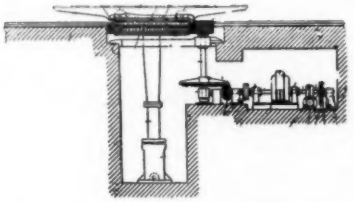
The object of this machine is to grind or surface toric, meniscus and other lenses accurately and rapidly. The invention was made with particular reference to its use in surfacing and grinding toric, meniscus and other lenses mounted on spotting wheels.

One feature of this invention consists in means for truing or maintaining in proper form an optical grinding or surfacing wheel, while it is performing its work of grinding or surfacing.

Another feature of the invention consists of means for maintaining the lens blanks and holder in position for surfacing or grinding the blanks, and particularly the stop construction for limiting the movement of the lens blank holder toward the surfacing or grinding wheel.

Mechanism for Shifting Plate-Glass Grinding Tables. U. S. 1,385,852. July 26, 1921. Frank E. Troutman, Butler, Pa.

The invention relates to apparatus for shifting plate-glass grinding and polishing tables.

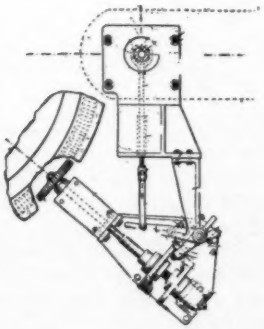


It has been customary heretofore to drive such tables with a high power motor so as to rotate the tables at a relatively high speed. Consequently, after the grinding operation, it was very difficult to shift the tables in order to "spot" the wheels with reference to the rails, due to the difficulty in stopping the high power motor at the desired point to effect the stoppage of the tables.

The object of the invention is to provide means for rotating the table very slowly and gradually in order to bring the wheels without difficulty into proper alinement with the track.

To these ends the invention consists, generally stated, in a grinding or polishing table having wheels adapted to engage a suitable track, means for disengaging the wheels from the track, means for rotating the table in its working position during the operation, and auxiliary means for rotating the table when the first-named rotating means is idle.

Mechanism for Cutting Off Molten Glass. U. S. 1,388,654. Aug. 23, 1921. Frank H. Lobb, of Millville, New Jersey, assignor to United Bottle Machinery Co., of New York, N. Y., a corporation of New York.



This invention relates to mechanism for cutting off molten glass, particularly for use in connection with machines for manufacturing glass articles, such as for instance glass bottles, by blowing, pressing or otherwise.

One purpose of the present invention is to provide reliable and effective means for causing the cutting mechanism to be operated by the mold-carrying machine positively and at exactly the proper time.

Another object is to construct the cutting device or knife and support it in such a way that it will be exposed to the heat of the molten glass in the furnace in a practically uniform manner and will therefore not be liable to wear out prematurely.

Still another object is to so construct and support the knife that it will always be in close contact with the plate or member in conjunction with which it performs its function of cutting off the stream of molten glass.

Abrasive for Grinding and Smoothing Glass. U. S. 1,387,649. Aug. 16, 1921. William L. Kann, Pittsburg, Pa.

Heretofore, glass, such as plate glass, has been ground and smoothed by the use of sand as an abrasive, particularly for the rough grinding. Emery has been used for the final smoothing operation, preliminary to polishing. Coarser grades of sand are used for rough grinding and finer grades for successively finer grinding, including part of the smoothing.

The natural mineral which the inventor claims to be best suited for this purpose is crystalline garnet. Garnet occurs both in massive form, termed "almandite," and also in crystalline form. The crystalline form is better adapted for grinding and smoothing, since the crystals when broken down to smaller particles will retain sharp edges of crystalline form. In other words, the larger crystals are made up of smaller crystals which retain their original crystalline characteristics. Therefore, when the prepared garnet material, crushed, sized and freed from its impurities, is applied to the rough grinding operation, properly graded and of uniform hardness and free from any foreign matter, to whatever extent it is broken down into smaller grains during this operation, to that extent material is provided which is suitable and advantageous for the finer operations.

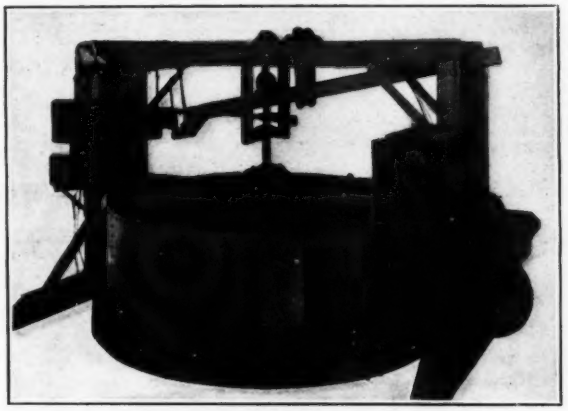
Glass Factory Equipment and Supplies

THE GLASS INDUSTRY will be glad to publish descriptions of new and useful devices, machinery and supplies of interest to the glass manufacturing trade. Most of the information printed in this department comes direct from the manufacturers of the products described.

Bergman Valve*

By HENRY W. HESS†

Operating engineers are now giving much time and attention to the development of temperature control, and are demanding continuous refinements in furnaces, gas producing apparatus and devices for handling the gas, and carrying away the waste products, all with as much efficiency of combustion and loss of heat while maintaining proper and even temperatures.



OPERATING POSITION

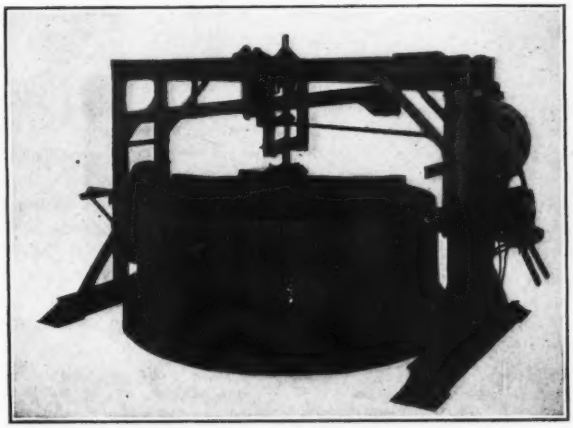
Construction companies are meeting this demand by careful study and experimentation in all directions. Noteworthy in this respect is a combination gas and air valve designed by W. G. Bergman, chief engineer for the McCamic-Batchell-Bergman Company, Toledo, Ohio.

This valve is unique and practical in that the gas and air are reversed by the same operation and simultaneously, either by hand or automatically, being controlled by clock work and motor or by thermostatic control; the thermostat being placed in the checker work of the regenerators. This latter is a most essential and valuable feature, and greatly facilitates the regulation of even temperatures.

This valve is circular in shape, being constructed of heavy sheet metal and lined with suitable brick. The gas which enters through the center passes into one of the six segments and then to a flue to the regenerators. The air enters from two ports situated in two of the six segments and spaced 120 degrees apart on either side of the gas segment. The air entering in one of the segments passes through an annular space, between the gas inlet and the waste gas segments, and then to the other air segment from which it passes to the regenerators. The waste gases enter the remaining two segments and thence to the stack.

The entire valve is water sealed and the duration of reversal is 10 seconds, during which time the valve passes through an angle of 120 degrees.

During burning out periods the producer is connected directly to the stack, the air and gas ports being closed, and thus allowing no cold air to enter the furnace.



REVERSING POSITION

The builders of this valve claim an exceptionally simple, safe and efficient mechanism, and are undoubtedly making an important contribution to the glass industry.

The accompanying photograph and cross section will show the general construction and operation.

*Photographs made from a model of the Bergman valve were shown in the November, 1920, issue of THE GLASS INDUSTRY. The illustrations shown above are of a full size valve.

†Consulting Chemical Engineer, Toledo, Ohio.

New Ceramic Material

A new material for use in the ceramic industry, "Carrara pure silica," has been put on the market by Innis, Speiden & Company, Inc., 46 Cliff street, New York, who state that this is a comparatively new variety and form of silica, differing from the sandstone and crystalline varieties in that it is an amorphous quartz or flint that is partially decomposed and somewhat hydrated. Its porosity makes for thin walls of the pores and this permits of lower temperature for melting or fusion. It analyzes about 99.6% SiO_2 with traces of magnesia, alumina and iron. It naturally is perfectly white and burns out whiter than the average flints now in use.

The company states that it is very desirable for use in porcelain and that they have had very satisfactory reports on its use in opaque glass from manufacturers who have tried it out.

Waste in the Glass Industry*

By E. WARD TILLOTSON, JR.†

Some years ago a writer aroused the indignation of glass manufacturers by stating that, despite much excellent management and notwithstanding the use of many ingenious machines, the main policy of the glass executive was to be described by the slogan, "Save at the spigot and waste at the bung." This expression, derived from a defunct industry, may divert the attention of the present reader from the main theme of this contribution and to some, in fact, the analogy may be quite unintelligible. The thought to be conveyed was that the manufacturer failed to recognize the necessity for obtaining certain essential information the lack of which often resulted in the loss of production for a considerable period of time or at least in the manufacture of an inferior product. The loss of a tank of glass due to the use of materials the unsuitability of which would have been indicated by chemical analysis was a case in point.

Glass Manufacturer Requires Facts

The same thought has been expressed recently to the writer by a prominent and successful glass manufacturer, who, speaking of the industry at large, says:

> We neglect facts; we reach decisions and take action without the readily available facts which bear on the matter in question or else we do nothing because the facts which would stimulate to action are not at hand. This is true not only of such information as physics or chemistry or mathematics can supply, but also of the facts which a study of simple records would reveal in the individual plant.

Waste Due to Management and Operation

Waste in the glass industry is of two sorts: The first type of waste results from the lack of proper management and is represented by poorly planned factories, inadequately constructed buildings which provide unpleasant and in some cases unhealthful working conditions, carelessness on the part of the workman, the improper selection of raw materials and the lack of standards for them, and the use of cheap labor for important operations such as the care of the gas producers and the regulation of the furnaces. As an instance, the owner of a small factory states that the systematic reading of gas meters and the constant checking of the proportions of gas and air entering the furnaces have resulted in a daily saving of 150,000 cu. ft. of gas.

Wastes Due to Materials

The second kind of waste is due to fundamental limitations of materials, particularly of the refractories, which necessarily are employed. No really satisfactory substance is available for manufacturing those parts of the furnace which come in contact with the melting glass or for the "crown" and other parts of the furnace. The refractories not only are dissolved slowly by the molten glass but also have a softening temperature only slightly above that of the furnace. Indeed, if the whole mass of the refractory block were to be heated uniformly to the temperature of the furnace, it would soften sufficiently to allow the structure to collapse. Consequently it is impossible to conserve fuel by insulating the furnace; but, on the other hand, it is necessary to increase the radiation (which amounts to around 40 per cent of the total fuel) by cooling the exterior by artificial means. Much of the product which is rejected, the "shrinkage," is discarded because of faults which may be traced back, either directly or indirectly, to the construction or operation of the furnace. Excessive loss of product also is caused, at times, by an occasional use of unsuitable batch materials and by a lack of control of the temperature in the lehr.

To Place the Glass Industry on a Scientific Basis

The glass industry, certain branches of which owe their present status to engineering, will eventually meet its problems in waste through the infusion throughout the industry of the principles of science, not only in the way of research and control from the standpoints of chemistry and physics but also in considering questions of hygiene (including the prevention of contagion, poisoning and injuries) and in placing the several operations and, in fact, the entire organization on a scientific basis. That the more successful glass manufacturers maintain intensive investigations of these and other problems is significant.

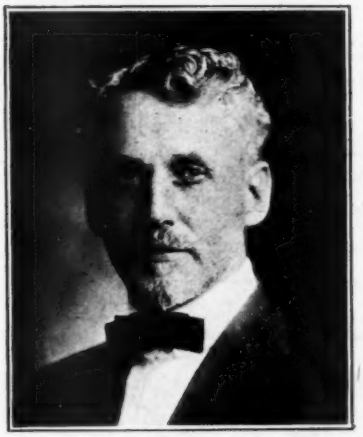
*Chem. and Met. Engr., Aug. 31, 1921.

†Assistant Director, Mellon Institute of Industrial Research.

Ross C. Purdy

The New A. C. S. Organizing Secretary

The American Ceramic Society was organized by Professor Edward Orton, Jr., founder of the first school of ceramics in the United States, in fact in the world. In 1917, the society was reorganized to meet war conditions and is today a progressive and aggressive organization for the promotion of ceramic technology and science. It now has about 1,500 members and having, in the opinion of a number of its members, reached a position where its present and projected activities demand the full-time attention of at least one man, the trustees as previously announced in these pages, at the summer meeting this year appointed Ross C. Purdy as Organizing Secretary.



ROSS C. PURDY

Practically all of Mr. Purdy's activities have been along ceramic lines. After graduating from the Buffalo, N. Y., High School, he entered Syracuse University in 1895 and the Ohio State University in 1896 to specialize in ceramics. On account, however, of his father's death, which occurred shortly after he entered the latter institution, he was thrown on his own resources and changed from the degree course to the two-year industrial course, upon completion of which he won, in competitive examination, the National Brick Manufacturers' Association scholarship, which enabled him to take a third year, thus completing two years of the required studies for a collegiate degree. He then took employment with the Mosaic Tile Company, Zanesville, O., as chemist, under Dr. Karl Langenbeck, the pioneer ceramic scientist in America. He filled various positions in this company and at the time of resigning in 1901, was assistant superintendent.

Mr. Purdy spent one and one-half years in the manufacture of pottery, specializing in art stoneware. In 1902 he returned to Ohio State University as laboratory assistant, taking part time collegiate work required for a degree. He accepted a call to go to the University of Illinois in 1905 to organize a ceramic department. He was the first professor of ceramics at the University of Illinois and the first ceramist on the Illinois State Geological Survey.

Having secured A. V. Bleininger in 1907 as fellow instructor, there was a vacancy at the Ohio State University which Mr. Purdy was asked to fill. This giving him an opportunity to complete his course for a degree, it was accepted. He was assistant director of ceramics in the Ohio State University in 1907-1908, full professor, 1908-1912. He then resigned to accept the directorship of research in the laboratories of the Norton Company, Worcester, Mass. In 1919, he resigned to enter consulting practice and in July, 1921, was appointed organizing secretary of the American Ceramic Society.

Mr. Purdy was president of the American Ceramic Society, 1909-1910, and was elected to the Honorary Scientific Society, Sigma χ, in 1908. He is chairman of committee C-8 on re-

fractories, American Society for Testing Materials, and a member of four other committees relating to ceramic products. He is a member of the United States Chamber of Commerce and several technical societies. Mr. Purdy has written broadly on ceramic subjects, his papers appearing frequently in scientific and technical publications. He has been one of the largest contributors to the Transactions and Journal of the American Ceramic Society.

His business connections include the vice-presidency of the Dover Manufacturing Company, Dover, Ohio, manufacturers of electric, flat and soldering irons.

Chemical Exposition a Success

The Seventh National Exposition of Chemical Industries, held in New York during the week of September 12, consisted of about 400 exhibits of chemical products and chemical equipment, of which about forty, listed below, were of special interest to glass men. In connection with the exposition, meetings were held of various technical and other societies. Friday, September 16, was Ceramic Day. In the afternoon a meeting of the society, attended by about fifty members, was held and a number of papers on ceramic and chemical subjects were presented.

CORNING GLASS WORKS EXHIBIT

A fairly good attendance of the society's officers and members at the headquarters, Booth 451, was shown by the registration records and a number of committee meetings were held. Motion pictures, including one showing the manufacture of pyrex glassware, were shown in the evening.

A large gathering of men from all sections of the country, such as the Chemical Exposition brings together, offers an exceptionally good opportunity for ascertaining the state of business throughout the chemical trades and it was noticeable that a distinctly optimistic feeling as to the immediate future, based on increased inquiries and orders reported from almost all sections, was manifested by nearly all of the exhibitors present.

Two glassware manufacturers were among the exhibitors: The Corning Glass Company's display was one of the most popular in the exhibition, being continually surrounded by a crowd of interested onlookers. The exhibit included pyrex low-expansion borosilicate laboratory glassware, pyrex glass cooking utensils and other products from the company's plants. An expert glassblower fabricating articles from pyrex glass kept visitors interested. The Whitall-Tatum Company's exhibit featured "nonsol" chemical glassware, bottles and other specialties made by this concern. Other exhibitors were:

American Water Softener Company, water filters.
American Ceramic Society.
Armstrong Cork & Insulation Co., insulating bricks, etc.
Bailey Meter Company, CO_2 recorders, etc.
Bausch & Lomb Optical Company, optical glass, etc.
Blaw-Knox Company, water cooled system, etc.
Brown Instrument Company, pyrometers.
Carborundum Company, abrasives.
Celite Products Company, heat insulating bricks, etc.
Chapman Engineering Company, gas producers, etc.
Chapman-Stein Furnace Company, glass melting furnaces.
Chadwick Boston Lead Company, lead oxide, etc.
Contact Process Company, salt cake, etc.
Container Club, The
Corning Glass Works, Pyrex glassware, etc.
Dings Magnetic Separator Company, magnetic separators.
Eagle-Picher Lead Company, glassmakers' red lead and litharge, etc.
Eimer & Amend, laboratory equipment, etc.
General Electric Company, air compressors, electric lehrs, etc.
Goulds Manufacturing Company, air compressors, pumps, etc.
Innis, Speiden & Co., chemicals.
Lakewood Engineering Company, materials handling equipment, etc.
Leeds & Northrup Company, pyrometers.
Magnesia Association of America, heat insulation.
Mathieson Alkali Works, Inc., soda ash, etc.
Mono Corporation of America, CO_2 recorders, etc.
Monsanto Chemical Works, salt cake, etc.
National Lime Association.
National Research Council.
New Jersey Zinc Company, zinc oxide, salt cake, etc.
Pennsylvania Salt Manufacturing Company, hydrate of alumina, cryolite, etc.
Permutit Company, water softening systems.
Quigley Furnace Specialties Company, insulating brick, furnace cement, etc.
Roessler & Hasslacher Chemical Company, glassmakers chemicals, etc.
Solvay Process Company, soda ash, etc.
Taylor Instrument Companies, pyrometers.
Thwing Instrument Company, pyrometers.
Uehling Instrument Company, CO_2 recorders.
Westinghouse Electric & Manufacturing Company, electric lehrs, etc.
Whitall-Tatum Company, scientific glassware, etc.

Safety Code for Compressed Air Machinery

The American Society of Safety Engineers has been designated as sponsor for a Safety Code for Compressed Air Machinery by the American Engineering Standards Committee. The code will include rules for the construction and use of compressors, tanks, pipe lines, and the utilization apparatus where compressed air is the active agent. In accordance with the usual procedure, the code will be formulated by a sectional committee composed of representatives designated by the various bodies interested.

Personals

C. H. PASCOE, who for several years has been eastern representative of the AMERICAN WINDOW GLASS COMPANY at New York, has been appointed western representative with headquarters in Chicago. Formal announcement of Mr. Pascoe's transfer to the new field of activity was made by W. L. Munro, president of the company, at the recent meeting in Chicago of the Western Glass Jobbers' Association.

It is reported that E. RICHARDSON, formerly of the glass technology department National Lamp Works, Nela Park, Cleveland, O., is now chief chemist of the Libbey Glass Manufacturing Company, Toledo, O.

FELIX A. DANDOIS has been engaged as manager of the plant of the Banner Window Glass Company, South Charleston, W. Va.

The J. R. Johnston Memorial

The memorial building which is being erected in honor of the late J. R. Johnston at Wallace, Nebraska, will, it is expected, be dedicated during the latter part of October. Captain Brown, chairman of the committee in charge of the memorial, J. G. Kaufman and A. W. Kimes form a sub-committee which will attend the dedication exercises at Wallace.

Ripe Olives To Be Brought Back Into Favor

There may be a bit of belated consolation for the glass container manufacturers whose interests suffered in consequence of the "ripe olive scare," in the plans of the California Olive Association for "a steady, methodical and insistent series of publicity campaigns" to effectually overcome the resistance of the distributing trade and the public to handling and using this product.

The advertising agency of Lord & Thomas, which will handle the proposed campaign is quoted as saying:

> "The first step toward regaining the confidence of the public in ripe olives, a part of which was recently lost through the incomplete sterilization of a few cases, which led to poisoning, will be an intensive campaign directed to the trade. The possibility of poisoning has now been eliminated by sterilization at 240 degrees for forty minutes, The purpose of the preliminary trade campaign will be to re-establish confidence in the quality of the association brands and to acquaint retailers with the actual facts concerning the situation."

No blame is placed on the glass container in connection with the alleged cases of poisoning caused by eating ripe olives. *Class*, a journal devoted to advertising, has this to say:

> "Lord & Thomas, who are handling the advertising for the association, say frankly that the cases of poisoning which were attributed to the use of ripe olives were due to insufficient sterilization. In other words, there was a real fault in the method of packing. No excuses are being made, but the association is going ahead with a better system of sterilization and assurance from scientific and food authorities that the olives as now produced are entirely healthful.
>
> "The association has a tough job ahead of it, of course, because when a product has been given a bad reputation it is hard to get rid of it. Advertising will accomplish that end, however, and undoubtedly the most important part of the advertising is that to the trade. Once the distributors are sold on the quality of ripe olives, and once they are convinced that proper educational work is to be done, they may be expected to take up again the promotion of the goods."

Rhodes Bill to Stimulate Increased Production of Non-metallic Minerals

Believing that the steps taken by Congress during the war, when large expenditures were authorized to encourage and stimulate the production of much-needed raw materials for the chemical industries, ought to be followed up now with vigorous action along the same line in order to prevent the country from again becoming dependent upon foreign supplies, Representative Rhodes, chairman of the House Committee on Mines and Mining, has introduced a bill authorizing the United States Bureau of Mines to proceed:

> (1) To conduct inquiries and scientific technical investigations in the United States and its territories concerning the mining, treatment and utilization of non-metallic minerals, such as sulphur, phosphate rock, feldspar, potash, mica, graphite, talc, barytes, limestone, and so forth, with the main object of elimination of waste both in their production and utilization.
>
> (2) To conduct investigations for the purpose of aiding in the efficient production of the non-metallic and other mineral raw materials for the chemical industry, and to investigate and obtain fundamental data needed for the efficient production of chemical products from mineral sources.

Mr. Rhodes reminds Congress that when the extremely pressing need of such minerals, many of which are absolute necessities in "essential industries," became known during the war, it was found they were undeveloped and he warns the public that prompt and effective action is needed to put and keep the United States on an independent basis as regards this class of raw materials.

Foreign Trade Notes

Under the provisions of a trade agreement recently concluded between France and Finland, a number of Finnish products, including glassware, may be imported into France at less than the general tariff rates.

The United States Postal Bulletin announces that a number of hitherto forbidden products may now be despatched to Italy by parcel post, including "glassware, jaded, engraved, gilded, silvered."

Importations into Czechoslovakia of table glass, porcelain and numerous other products manufactured in large quantities in that country, are prohibited. The export tax on concave and window glass has been abolished and on luxury glass it has been reduced to one-fourth per cent of the invoice price.

Effective September 1, 1921, the maximum weight limit of parcel post packages exchanged between the United States and Switzerland is increased from 11 pounds (5 kilograms) to 22 pounds (10 kilograms), the transit rate on parcels exceeding 11 pounds in weight is 18 cents.—*Commerce Reports.*

More Time for Filing Express Claims

The American Railway Express Company has issued Supplement No. 5 of Official Express Classification No. 27, calling attention to changes in regulations covering the filing of claims for delay, loss or damage. The new rules, effective September 10, 1921, extend the time allowed for filing claims from four months to six months after date of delivery, and in cases of non-delivery to six months and fifteen days from date of shipment.

Canadian Marking Regulations

By an Order-in-Council of August 13, 1921, the date of the coming into effect of the provision for the marking of imported articles with the name of the country of origin has been postponed from October 1 to December 31, 1921.

Inquiries Received

Further particulars may be obtained from THE GLASS INDUSTRY

35.—(From China.) Please put me in touch with concerns making electric light bulb and vacuum bottle making machines.

36. Please tell us who manufactures machinery, molds, etc., for making and finishing watch crystals, particularly fancy types such as octagon shapes, etc.

37.—Kindly give us the names and addresses of concerns manufacturing glass tobacco jars.

38.—Kindly refer us to manufacturers of glass stoppers.

39.—We are building a factory to manufacture frosted electric light bulbs, shades, table specialties, etc., and are in the market for new and used equipment including lehrs, molds, air compressor, fans, blow pipes, snaps, spraying machines, etc.

40.—We shall be in the market for a large quantity of bottles of different styles and sizes. Kindly put us in touch with manufacturers nearby (West Pittston, Pa.).

Coming Meetings and Other Events

AMERICAN CERAMIC SOCIETY—Twenty-first annual meeting at St. Louis, Mo., February 27 to March 2, 1922.

AMERICAN GAS ASSOCIATION—Third annual convention at Congress and Auditorium hotels, Chicago, Ill., November 7 to 12, 1921.

SOCIETE DE CHIMIE INDUSTRIELLE DE FRANCE—First annual meeting in Paris, October 9-12, 1921. The section on Glass, Ceramics, and Enameling will take part. In conjunction with the meetings a chemical exposition will be held.

THE OPTICAL SOCIETY OF AMERICA will meet at Rochester, N. Y., October 24, 25 and 26 at the Hotel Rochester. Arrangements are being made for visits to the glass works of Bausch & Lomb Optical Company and also to the Eastman Kodak Company plant.

NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURES—Annual convention and fixture market at the Auditorium, Milwaukee, Wis., January 30 to February 4, 1922. Chas. F. Hofrichter, secretary.

News of the Trade

THE GLASS INDUSTRY will be glad to receive notices of new glass manufacturing projects, plant extensions, removals, personal items, etc.

Receivers have been appointed to take over the assets of MICHAEL MARX of the BROAD TRADING COMPANY, New York, importer of Belgian glass.

THE BULLET PROOF GLASS CORPORATION, has been incorporated with $1,000,000 capital by H. L. Elers, William H. Mayhan, J. L. Cunningham, New York.

THE CAMERON GLASS AND MANUFACTURING COMPANY Cameron, Ohio, has been incorporated with a capital of $60,000 by James A. Frank, James F. Donahue, James A. Whelan, Mrs. J. F. Whelan and R. T. Straub.

The following officers were elected at the recent annual meeting of the JOHNSTON GLASS COMPANY, Hartford City, Ind.; J. R. Johnston, Jr., president; J. A. Jay, vice-president, and George T. Fulton, secretary and treasurer.

THE NATIONAL POTASH COMPANY, Gravenhurst, Ontario, Canada, are erecting a plant for the manufacture of a general line of glassware. Contracts for building a six-ton tank and a lehr have been made with B. F. Morton, Hoboken, Pa.

The new power plant of the BARTLETT-COLLINS GLASS COMPANY, Sapulpa, Okla., has been completed. It is equipped with two new 150 H. P. engines as well as a 50 H. P. and one 100 H. P. engine, three generators and two air compressors.

Press reports state that the CENTRAL GLASS COMPANY, of Huntington, W. Va., has established a new plant at Cincinnati, O., with Frank Collins in charge. The company also has plants in Louisville, Ky., Chattanooga, Tenn. and Kansas City.

THE MILLER MACHINE AND MOLD WORKS, 721 Ann street, Columbus, Ohio, have announced a straight reduction of 10 per cent on all of their automatic pressing and blowing machines. The company states that they are now quoting pre-war prices.

Announcement has been made that the SHARP-SCHURTZ COMPANY, glass chemists and consulting engineers, Lancaster, Ohio, whose president, Chester L. Sharp died recently, will continue under the old firm name under the management of D. D. Schurtz.

THE SANITARY BOTTLE MANUFACTURING COMPANY has been incorporated with a capital stock of $200,000 to acquire and develop certain patents on bottles. The incorporators are: L. O. Culver, West Pittston, Pa.; George W. Culver, Forty Fort, Pa., and D. O. Coughlin, Luzerne, Pa.

THE OWENS BOTTLE COMPANY Toledo, Ohio, have opened branch offices at 304 Iroquois Building, Buffalo, N. Y., in charge of K. V. Wisler, and at 1301 Peoples Bank Building, Pittsburgh, Pa., in charge of R. M. Gardner, formerly manager of the company's factory No. 3, Fairmont, W. Va.

THE FREDONIA WINDOW GLASS COMPANY, Fredonia, Kans., according to a press report, is contemplating the erection of a glass manufacturing plant at Long Beach, Cal., and it is expected that construction will begin at an early date. C. E. Lutz, is president and general manager of the company.

THE HENRYETTA GLASS MANUFACTURING COMPANY, Henryetta, Pa., has been incorporated with a capital stock of $50,000 to manufacture lamp chimneys, bulbs, gas globes, electric shades, automobile lenses and paste mold products. The company is erecting the first unit of its factory building, and it is expected that when completed about eighty men will be employed. The incorporators of the new company are: J. B. Allison, George W. Allison, C. D. Murphy, H. L. Chambers and Frank H. Miller.

THE OLD DOMINION GLASS CORPORATION, Alexandria, Va., announces that no damage was done by fire to its plant as stated in press reports, but that the fire was confined to a houseboat anchored near the glass factory. The company also announces that the plant is in operation making a full line of bottles, including prescription, soda, milk, half gallon and gallon packer bottles. The officers are: L. Wolford, president, R. E. Bottenus, vice-president and general manager, George Schwarzmann, treasurer, and Ervin G. Schwarzmann, secretary.

THE AMSLER-MORTON COMPANY, Parkview, Pa., announce that they have received contracts for two muffle lehrs for the Standard Glass Company, Marion, Ind., and for four lehrs for the Marion Bottle Company, Marion, Ohio. The company is also constructing four lehrs for the Capstan Glass Company, Connellsville, Pa.; twin tanks for the Jeannette Glass Company, Jeannette, Pa.; and are making alterations on two tanks at the Mt. Pleasant and Greensburg, Pa., plants of the L. E. Smith Glass Company. They have also secured a contract for two lehrs for a factory in Bogota, Colombia, South America.

THE ORIENTAL ART GLASS COMPANY, 2300 Warren street, Chicago, Ill., has been incorporated with a capital stock of $250,000, to manufacture all kinds of colored glass, including sheet, optical, electric lighting and colored specialties. The officers of the company are: Robert Malcolm, president and treasurer; F. King, secretary; A. E. Saunders, vice-president and general manager, and the directors Robert Malcolm, chairman, F. King, A. E. Saunders, A. M. DeVry and T. Harper. Mr. Malcolm, organizer of the company, is known in the optical trade as the distributor of Essentialite glass. A. E. Saunders of New York has also been long known throughout the glass trade as a practical glass man and factory manager. The company is erecting a factory in a suburb of Chicago.

THE AMERICAN FOURCAULT MACHINE COMPANY has been incorporated under the laws of the State of Delaware to manufacture and deal in sheet glass drawn by the Fourcault process. The company is capitalized at $100,000 and the incorporators are C. T. Cohee, and R. E. McCloskey.

It is reported that Jules J. Quertinmont, of the J. J. Quertinmont Glass Company, Point Marion, Pa., has secured exclusive rights to the use of the Fourcault process in North America and with his brother, John B. Quertinmont, organized the American Fourcault Machine Company, with J. J. Quertinmont as president; Frank Bastin, Vincennes, Ind., 1st vice-president; A. S. Maple, Point Marion, Pa., 2nd vice-president; Florise Duliere, Point Marion, secretary-treasurer; these officers with H. R. Conklin of New York, constituting the board of directors. Press reports state that L. B. Brownfield, of Uniontown, Pa., attorney for Mr. Quertinmont, announced that Fourcault machines, built in Belgium, would be installed immediately in the new Quertinmont plant at Fairchance, Pa., the Jeannette glass factory at Point Marion, and the Blackford Window Glass Company's plant at Vincennes, Ind., eight machines to be put into each of the three factories within eight months.

The Fourcault process as operated by its inventor in Belgium, was described in the August, 1921, issue of THE GLASS INDUSTRY.

Hartford-Fairmont Machines at Bridgeton

A new type of bottle machine, whose operations ought to prove of interest to bottle users all over the country, will start work either the latter part of August or the first of September in Factory A of our new plant at Bridgeton, N. J.

The No. 7 furnace in Factory A has been entirely rebuilt and is equipped with three automatic Hartford-Fairmont units, each unit consisting of a Hartford-Fairmont paddle feeder and three automatic forming machines. Of the forming machines, six will be of the narrow neck type and three of the press and blow model.

The present occasion marks only the first installation of this new automatic bottle making machine at Bridgeton; many more machines will be added from time to time, not only in Factory A, but in Factories B and C.

This new equipment is entirely automatic, with no mixed operations of any kind. It will operate in flint glass without license restrictions and turn out bottles of every description.—From *Bottles*, published by Illinois Glass Company.

Trade Publications

THE VARIETY OF FURNACE DESIGN, Bulletin No. 232. W. S. Rockwell Company, New York. Contains over 200 diagrams illustrating the principal characteristics of different types of furnaces, mainly those used for the heat-treating and melting of metals and metallic alloys.

BURY COMPRESSOR COMPANY, ERIE, PA., BULLETIN 407. A description of the Bury three-cylinder, two-stage universal, variable volume, motor-driven, air compressor, with automatic Bury patented pyramid box plate intake and discharge valves and other special features. Also Supplement 407 containing descriptions abridged from the company's general catalog of other Bury air and gas compressors, vacuum pumps, etc.

LIQUID FUEL BURNERS FOR THE GENERATION OF STEAM is the title of a new Bulletin LF 103, issued by The George J. Hagan Company, furnace and fuel engineers, People's Bank Building, Pittsburgh, Pa. The bulletin discusses, briefly, steam boiler practice and describes the Hagan Mechanical Burner and Steam Atomizing System, accessory apparatus, and other matters pertaining to modern steam power plant equipment.

WATER COOLED APPLIANCES FOR GLASS TANK FURNACES.—A 16-page booklet issued by Blaw-Knox Company, Pittsburgh, Pa., describing the construction and application of Blaw-Knox rolled steel coolers for glass tanks and furnaces. The methods of installing the coolers at the port, skewback, tongue, jamb, throat, dog-house, side walls and elsewhere are illustrated by diagrams and explained in the text. The Knox air and gas reversing valve which is, essentially, a simple vertical water-cooled damper, is also described briefly.

Stock Quotations

(Reported by Moore, Leonard & Lynch, Frick Building, Pittsburgh, Pa.)

Pittsburgh Stock Exchange—September 28

	Bid	Ask	Last
American Window Glass Machine Com.	67	70	69½
American Window Glass Machine Prf..	74	..	74
American Window Glass Pfd.....	..	95	95
U. S. Glass	..	50	36

Market dull with pronounced strength in Pittsburgh Plate Glass.

Wheeling Stock Exchange—September 28

	Bid	Ask	Last
Fostoria Glass Company	105	110	110
Hazel Atlas Glass Co.....	148	150	150
Imperial Glass Company	90	100	100
Central Glass Company	..	154	155

Hazel Atlas strong and active.

Toledo Stock Exchange—September 28

	Bid	Ask	Last
Libbey-Owens Sheet Glass Com.....	103	108	105
Libbey-Owens Sheet Glass Pfd.....	96½	97½	97
Owens Bottle Machine Co. Com.....	27	29	29
Owens Bottle Machine Co. Pfd.....	95	96	95

Market dull.

Monthly Summary of Foreign Commerce of the United States in Glass

Corrected to August 18, 1921.

IMPORTS OF GLASS AND GLASSWARE.

Articles	July 1920 Quantity	July 1920 Value	July 1921 Quantity	July 1921 Value	Seven months ending June 1919 Quantity	1919 Value	1920 Quantity	1920 Value	1921 Quantity	1921 Value
Glass and glassware:										
Bottles, vials, demijohns, carboys, and jars, plain, ordinarily used as containers, empty or filled ..... lbs. dut.	771,705	$41,562	896,125	$41,723	446,397	$24,410	2,544,070	$119,367	4,043,443	$187,609
Bottles, decanters, and other glassware, cut or ornamented ..... dut.	.....	151,704	.....	152,151	.....	224,223	.....	440,379	.....	823,374
Optical instruments, including lenses and spectacles ..... dut.	.....	106,874	.....	97,598	.....	131,330	.....	420,346	.....	627,532
Sheet and plate glass—										
Cylinder, crown, and common window glass, unpolished ..... lbs. dut.	491,586	52,625	3,789,137	186,196	409,285	44,654	3,062,904	305,557	30,513,574	1,753,366
Plate glass, cast, polished, unsilvered, sq. ft. dut.	380,156	341,704	150,788	95,864	.....	.....	823,798	664,182	1,537,269	1,188,040
Plates or disks, rough-cut or unwrought, for optical purposes ..... lbs. free	83,263	96,476	16,085	24,189	377,290	259,401	515,333	540,745	548,201	488,634
All other ..... dut.	.....	182,453	.....	286,939	.....	316,564	.....	849,000	.....	1,453,695
Total	.....	$973,398	.....	$884,660	.....	$1,000,582	.....	$3,339,576	.....	$6,522,250

EXPORTS OF GLASS AND GLASSWARE.

Glass and glassware:										
Bottles, demijohns, carboys, and jars	.....	$788,469	.....	$283,183	.....	$2,593,735	.....	$5,714,377	.....	$3,482,206
Chemical glassware	.....	18,361	.....	17,419	.....	115,747	.....	130,710	.....	162,049
Common window glass, boxes (50 sq. ft.).	48,796	325,062	2,391	15,677	616,486	4,286,182	354,608	2,421,081	51,373	410,748
Exported to—										
France	.....	.....	.....	.....	207,323	$1,661,321	94	$698	.....	.....
Canada	34,797	$208,318	35	$269	57,365	302,561	173,715	1,077,428	6,800	52,046
Mexico	1,100	15,467	1,385	8,693	16,679	121,641	12,699	115,650	17,022	142,142
Cuba	2,466	18,377	382	3,343	8,603	66,247	23,407	162,756	5,826	52,722
Argentina	498	3,025	.....	.....	75,149	520,908	12,805	107,213	2,440	17,205
Brazil	130	1,044	.....	.....	45,838	287,856	21,457	154,864	2,128	12,191
Chile	545	3,634	.....	.....	22,163	149,891	10,835	64,954	168	1,791
Uruguay	.....	.....	.....	.....	.....	.....	1,985	14,498	2,318	14,077
China	600	3,000	30	396	.....	.....	22,334	150,180	1,190	11,822
Japan	2,100	20,461	.....	.....	5,119	59,431	15,339	134,713	70	944
Australia	1,458	10,761	.....	.....	93,628	564,331	8,985	69,593	1,648	12,423
New Zealand	68	497	.....	.....	23,536	130,961	2,855	20,927	8	54
Other countries	4,875	41,078	359	2,976	61,083	421,034	47,498	347,607	11,746	93,331
Cut or engraved glassware	.....	$31,237	.....	$14,230	.....	$138,897	.....	$235,319	.....	$129,929
Plate glass, unsilvered ..... sq. ft.	318,781	190,023	145,782	77,045	5,398,827	3,121,353	2,817,974	1,768,946	1,557,659	990,406
All other	.....	890,910	.....	393,564	.....	4,574,257	.....	6,695,893	.....	5,649,546
Total glass, etc.	.....	$2,244,062	.....	$801,224	.....	$14,828,171	.....	$16,966,326	.....	$10,824,884